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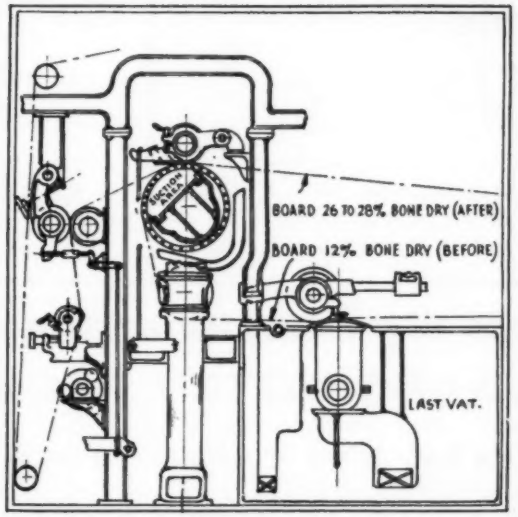

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THE PAPER INDUSTRY

OCTOBER, 1935
Vol. 17—No. 7

A MONTHLY EDUCATIONAL JOURNAL
Devoted to the Interests of the Pulp and Paper Industry

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EDWARD B. FRITZ, Publisher
A. SCOTT DOWD, Editorial Director
HARRY E. WESTON, Editor

PUBLICATION OFFICE
Chicago, Illinois
333 N. Michigan Ave.
Dearborn 8877

Eastern Office
New York, N. Y.
342 Madison Ave.
Murray Hill 2-7358

Pacific Coast Office
Los Angeles, Calif.
1031 S. Broadway
Westmore 8501

Entered as second-class matter at the Post Office at Chicago, Illinois, February 13, 1920, under the Act of March 3, 1879. Subscriptions in the United States, Alaska, Hawaii, Philippines, Porto Rico, Cuba and Mexico, $2.00 per year. Canada, $2.50 per year. Other countries, $3.00 per year.

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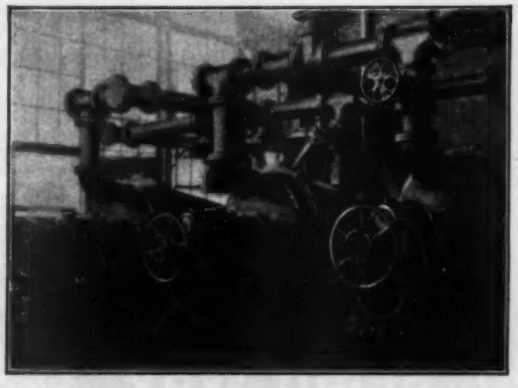

The Paper Business Is on the Up and Up

THE paper business is on the up and up. We have been stressing this fact to our readers for some time past, but we fear the reiterated statement has met with incredulity, for it was reasonable to argue "How could the paper business with a large overproduction and a drastic curtailment of demand for its products, plus the demoralized price and market conditions as a consequence, be on the up and up again?" Nobody but a rank optimist, wearing rose colored glasses all the time, and devoid of all economic sense, could make such halycon predictions. If these be not just the words that were said, at least, it was about the substance of the mental conclusions many of our readers harbored.

And yet, the paper business has been on the up and up all the time. It has kept on the up and up until now it looks as though it will be but a few short months—perhaps only weeks—before it will be apparent to every one that the paper market will be dominated solely by the sellers and the six long lean years of a buyer's market will have ended. Then—and not until then—shall the industry prosper again.

And it is pertinent to inquire "How come? How did such a radical turn-about come to pass?"

The facts are: We have been passing through a nation-wide, world-wide intense economic period. For six years, the nation has been revamping its production and manufacturing processes basically. There has been determined research continuously carried on, seeking the production of better quality goods at lower costs to the consumers. Out of this welter of work and study, it now appears that the nation is turning to the paper industry for its basic raw materials. Almost every conceivable article of commerce, which hitherto has been fabricated from cotton, silk, wool, glass, tin, wood, lumber, etc., has been put through substitution tests in the paper and commercial laboratories during the past five years.

And there has emerged therefrom marvelous new products. New fabrics have been evolved from cellulose fiber whereby whole divisions of the fabric industry have gone over to wood fiber base from the cotton and silk base. Millions of glass milk bottles have already passed from glass to the paper container base and hundreds of millions more are in the immediate offing, requiring tens of thousands of tons of paper. And this development is in its infancy, but growing by leaps and bounds.

Containers of all kinds, shapes and description formerly made from tin and other bases have gone to the cellulose basis.

And as for shipping containers and packaging containers, there seems to be no top limit to where that tremendous tonnage may go.

Five years ago, less than 200,000 tons yearly of Kraft liner board were made in that division of the industry. In 1935, a total exceeding 665,000 tons will be shipped from mills of the Kraft division alone.

To attempt to list the tonnage required for paper and paper mill products in new uses and for new commodities would take more time and space than we can command, but most significant is the fact that while in 1934, the total consumption of paper mill products in these United States was 9,186,225 tons, 4,720,321 tons—over 50 per cent of the total—was in board, building insulating and for other conversion purposes—a startling increase in paper stock use for substitute purposes.

There are no inventories, stocks, reserves or surpluses of paper of any kind anywhere, but restocking for inventory and reserves is now beginning to appear.

Again, we say—the paper business is on the up and up. Watch the orders come in!

+ EDITORIAL +

Safety . . . An Individual Responsibility

THE populace of Chicago and its environs recently became apprehensive when it was reported that several poisonous snakes had escaped from their cages at the zoo just west of the city. The curator, who was not afraid of the reptiles, had thoughtlessly left the cage door open and the snakes left their abode while the zoo was crowded with visitors. The snakes were at large for days before they were found—one, the most deadly of them all and very rare—remained missing for some time before it was found.

Every human being has certain definite responsibilities for the safety of his fellowmen. Such responsibility, of course, should not be born of fear, but it should be developed through scientific mental training. The complacent person who rests on his own knowledge and his calm, well-balanced mental attitude is often prone to feel that he has advanced beyond the point of carelessness—he has no fear that an accident can happen to him. However, safety is not entirely an individual problem—it is an intangible chain of correct and orderly thinking which is expressed through the activities of the human family.

In the leading article of this issue, the author refers to the industrial trinity as "materials, methods and men." The application of phychology to the ills of human behavior has brought a new science into the industrial field. In some of the larger organizations the professional psychiatrist has found a new realm. The personnel manager of today must rely to some extent upon the fundamentals of psychology to assist him in handling the human member of the industrial trio.

Perhaps nowhere in the management of any industrial plant—be it large or small—is the application of psychology so timely and so valuable as in the control of accidents. Accidents usually occur because of the failure of one of the two elements—machinery and men.

Mechanical science has developed to a point where great sums have been spent by manufacturers to eliminate or to guard any dangerous parts on their machines. Mechanical safety, it seems, has far outdistanced the progress of the human element, and man, who has mastered mechanical hazards, is responsible for a major percentage of accidents.

Manpower is one of industry's heaviest assets—though one that does not appear on the balance sheet. Men are not robots; but they can be trained to think and act scientifically. And since an efficient worker represents an industrial investment, any accident for which he may be held responsible should be analyzed, not so much for the details of the accident itself, but to discover the underlying cause of the accident in the mind of the worker.

When a machine fails or causes some damage, ordinarily it is not discarded—skilled mechanics are put on the job. And so a psychological investigation of many accidents will uncover defective thinking that can be adjusted easily and harmoniously.

"Just Because"

HAVE you ever made a special run of paper for a customer, who, upon receiving it, decided that it was not wanted; and in his rejection of it gave as the reason only the two words—"just because?"

It may be that paper has not been rejected on such a flimsy pretext or that rejections are made only by customers with legitimate complaints. Yet, it is believed that the executives of some of the mills could recite some rather heartrending experiences that they have had over a period of years with a very limited number of customers about this matter of rejections. No doubt some of the excuses made by these would-be purchasers would not stand up under analysis, but, nevertheless, they have caused plenty of grief on the part of producers at the time of individual rejections.

Of course there are two sides to every situation and the papermaker in rare instances probably is not immune to the use of similar tactics in regard to purchases made by him. It might be reflected in the purchase of some raw material, some auxiliary item perhaps of little consequence to the actual efficient functioning of the plant, or some equipment item that may have been manufactured specially for the specific installation and had been installed on trial.

Of course, some equipment manufacturers realize that trial installations are necessary at times to demonstrate beyond a question of doubt that the equipment thus installed will deliver the goods. They welcome the opportunity to prove their claims, and stand ready, if they are the right kind of manufacturer, to retire from the scene of action as gracefully as possible in case of a failure and to allow for the return of the equipment that failed to do what was claimed of it. On the other hand, is it fair to expect of them, in case of sufficiently long trial runs that have been most satisfactory, to respond graciously to a rejection with the only reason given for it being, "Just Because"? Shouldn't the equipment manufacturer expect the same kind of treatment from those with whom he is doing business as the paper manufacturer expects from his customers? There is only one answer—"Most assuredly!"

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FLEXIBILITY—*AIR-o-LINE* is easily adapted to any process control requirement. The *Throttling Range and Automatic Reset Dials* are easily accessible, reached without removing the chart plate and without taking the instrument off control.

Brown *AIR-o-LINE* is more than a controller—it's a system of control that will aid you to reduce costs.

For complete information, write for catalog No. 8900. The Brown Instrument Co., 4489 Wayne Avenue, Philadelphia, Pa. Offices in all principal cities. Canadian Factory: 117 Peter Street, Toronto, Ontario, Canada.

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FEATURES

Throttling Range Dial
Automatic Reset Dial
Calibrated Control Index

Other features are fully described and explained in catalog 8900. Write for it.

BROWN AIR OPERATED CONTROLLERS

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Under the Rule of Science

By WILLIAM SIBLEY

NOT far from the site of the great, sky-piercing tower of radio station W L W (Cincinnati) there stands a filling station, busily engaged in relieving the thirst of the pulsing motor cars which pause at that highway intersection. . . . A commonplace fact. This filling station is one of the best lighted stations in that entire neighborhood. . . . A none too interesting fact. All the electric current used by this filling station (for lighting at night) costs not a single red cent. . . . A very interesting fact.

As I said before, the filling station stands hard by the broadcasting tower of the 500,000-watt W L W. By the simple process of applying the radio-broadcasting principle demonstrated at the Chicago World's Fair for illuminating electric light bulbs by radio, this filling station manager has had built a comparatively simple device which picks up the electrical leakage from that tower, and makes that electrical energy illuminate his entire station—without cost either to himself or to the radio station owners.

Here is manifestation of the truth that some day we will be getting our heat, light and power by radio; that heat, light and power will sometime be as cheap as water. Our automobiles, railway trains, airplanes, trucks, tractors, plows, binders, and whatnot will be electrically operated. And we will be as free to drive into a stranger's yard and ask that our emergency batteries be recharged as we are now to ask for a drink of water.

The engineer, the chemist and the physicist rule us today. They will rule us with increasing dominance in the early tomorrow.

Already vast changes have been effected. One hundred and fifty years ago 90 per cent of our population was engaged in agriculture. Today, only 20 per cent of our population is engaged in agriculture, and even that small percentage, thanks to modern mechanization, is much larger than necessary. If every farmer would employ all the modern labor-saving and aiding machines and methods at his disposal, our farm population could be reduced six-fold, yet with production entirely adequate and the ultimate consumer costs considerably reduced.

Every tractor replaces horses enough to reduce food consumption equal to having 30 people stop eating. Through the invasion of the gasoline engine and its concomitant replacement of horses there already has been a reduction in crop consumption equal to having nearly 35,000,000 people cease eating. An equal effect on crop consumption has been effected by the replacement of horse-drawn drays by motor trucks. Additionally, the extent to which automobiles have taken the U. S. citizenry off their feet, have put them on wheels, and while reducing walking also have reduced appetites, has caused a generous 15 per cent reduction in meat consumption.

Science and engineering make every industry interrelated; every person dependent upon every other person. Thus also are science and engineering contributing heavily to the steady advancement of synthetics. With fewer horses, cattle, sheep and hogs to raise and feed, more acreage is released for the production of products to be used synthetically. Far-sighted scientists and chemists are turning to the development of synthetic products, if only to find a way to employ our farm lands. Working side by side with them is the "agri-biologist"—developing methods for multiplying crop production. Cotton production has been raised from one-third bale to the acre to 3.5 bales an acre. Wheat production already has been so increased by improved methods, that were they employed widely, the state of Montana alone would be able to raise all the wheat the United States, Canada and the British Isles could consume. It may sound chimerical, but not long hence housewives will grow all the green vegetables they need in their own kitchens—in a box no larger than an ordinary refrigerator.

Such facts are far more than merely interesting. They are facts that penetrate far-reachingly into the lives and businesses of every one of us. They mean the destruction of practically every monopoly. Already we are producing dyes and perfumes in such quantities and with such qualities that we are (or could be) entirely independent of Europe. Formerly Chile enjoyed a monopoly on nitrate; Japan on camphor. No longer do those monopolies obtain—thanks to the science of synthetics. With the release of thousands of acres of land and the development of rapid growing trees—plus the constantly increasing demand for insulation (due to air-conditioning of homes, factories and offices) we can envision enormous pontentials for the paper industry.

In another fifty years the paper industry will not be in the position it is now. It will be five times as great and twenty times as important.

THE PAPER INDUSTRY
A MONTHLY EDUCATIONAL JOURNAL

Psychology . . . . Its Application to Industry

C. M. LOUTTIT

MODERN industry has been reared on a foundation of science. This aphorism is as true for the paper industry as for steel, soap, or heavy chemicals. Every step in the manufacturing process from the log or rag to the finished sheet owes its debt, in greater or lesser degree, to the scientist and to the engineer. By long odds, physics and chemistry have served the needs of industry most abundantly; but such service has been wholly to materials and methods. Without a third member of the industrial trinity materials and methods are just that and no more. Logs will not become newsprint; boilers will stand cold; calender rolls will be static steel; stocks will stay on the shelves; industry will stop, without the third member—men. Materials, methods, men—this is the industrial trinity. The interdependence of these three is self-evident, yet the sums spent on the scientific investigation of materials and methods surpass those spent on the scientific investigation of men in such a ratio that the author would be unwilling even to estimate them.

Of all the sciences having to do with the study of men psychology has probably the most widespread industrial application. The medical sciences are of importance in matters such as the physical stamina and health conditions of the worker and the possible effects of the working environment upon these. Of course, when the workman is injured or in ill health medicine is called upon. Anthropology and other sciences dealing with man as an organism are seldom involved in industrial situations. But psychology is involved in all matters which are concerned with, or affected by, human behavior. In this article, it will be possible to do little more than suggest places where psychological methods and data may have pertinence in the paper industry.

Materials and methods, no matter how adequate, are efficient only in so far as the men who use them are efficient. Problems of plant personnel afford probably the widest and most important field of psychological application in industry. For greatest efficiency, each man from the humblest roustabout to the chief executive must be fitted to his job. Questions of general ability, possession or acquisition of skills, emotional stability, personality integration, outlook on life, and others must be considered. No reasonable psychologist ever could claim that his science had ready answer to all of the many problems that might arise. That science, however, can offer some methods making for greater satisfaction, and can attack problems of human behavior with greater facility than any other.

First, consider the matter of personnel selection. In the March, 1935, issue of THE PAPER INDUSTRY there appeared an advertisement recalling the good old days when the specification for a papermaker required him to:

(1) cuss like a drunken sailor
(2) chew natural leaf tobacco
(3) drink rot-gut whiskey
(4) wear a greasy shirt
(5) be equally accurate with either foot on a back tender's posterior
(6) blame everything that went wrong on either the beater engineer, the millwright, or the back tender.

These specifications are supposed to go back some fifty years. Because of these, or perhaps in spite of them, the papermakers of that day had a further ability—"they knew paper." And from the point of view of

the modern industry this last was by far the most important characteristic.

"Know paper." This, in a literal or figurative sense, is the *sine qua non* of employees in the paper industry. It is the job of the person who selects personnel, whether he is a psychologist or a plant foreman, to pick those men who do know their job or present a reasonable expectancy of being able to learn the job. Such selection may be, and often is, by rule of thumb, with the possible result that a month or two later the man must be fired because he is unable to learn the task he was hired to do.

Psychology is prepared to offer a somewhat more rational means of selection than this. A young man enters the employment office; he has had no experience in any factory or mill. The question is whether he can be trained to be a successful workman. Every job requires certain characteristics. The man must be sufficiently intelligent to learn what is required of him; he must have a requisite speed and skill in motor response; he must have satisfactory sensory acuity, and so on. There are available today a large number of testing instruments designed to give some indication of an individual's capabilities. The applicant's schooling may or may not be an indication of his intelligence. An hour's test will prove a better basis for predicting what can be expected from him. The chances are against a man with a test score below certain limits ever being successful as a foreman, or on a job requiring paper and pencil work. On the other hand, men with superior abilities are seldom really adjusted to routine tasks and are, therefore, not efficient. Similarly, performance on motor co-ordination or motor speed tests, or specific trade skills, or on educational achievement tests may serve to give a clearer idea of what the workman may do best.

Such examination methods have value not only in the original selection of men but also in their placement on specific jobs. It is poor economy to set a skilled patternmaker wheeling a barrow. It is equally poor economy to try to train a moron to any responsible position. The selection of workers and the placement of the right man on the right job is a part of the whole problem. But knowledge of the man is of little value unless rather specific requirements for each job also are known. Therefore, the personnel officer also must undertake job analyses because in this field psychological investigations have resulted in pertinent knowledge.

Industry always has the task of training new workers. Regardless of how menial a particular job may be there is some cost involved in training a new man to do it satisfactorily. As jobs become increasingly skilled this cost is increasingly greater. Therefore it is economy to direct attention to such training problems. Each plant has specific requirements to meet in its individual conditions. But the psychologist may offer valuable ideas on training procedures based on our present knowledge of the phenomenon of learning. Such questions as: how long training periods should be, the length and frequency of daily practice periods, whether or not a whole process should be taught as a unit or be broken up into parts, how much transfer might be expected from training in one type of skill to a second type, relations of speed and accuracy, the best methods of work, and so on, have been studied in the laboratory and to a lesser degree in the plant. At least partial answers are available for all of them, and the trained psychologist is ready to attempt the application of available methods and data to plant problems.

Thus far it has been pointed out that the task of the personnel psychologist is to find square holes for square pegs and vice versa. But there are further problems, because human beings don't stay square or round. Here is a man who measures up to the requirements of the particular job, yet he is not successful in it. The square peg is distorted, or the round peg has begun to square. This is illustrated in the following account which may have occurred in the reader's experience. A man had worked in a certain department for a number of years. He was highly skilled, deeply interested in his job, and saw the job in its broader relations. In fact, he had acted as the foreman of his department for short periods on several occasions. When, because of the death of the foreman it became necessary to select a new one, everyone agreed this man was best qualified to fill the place. After a month or two as foreman he became officious, hypercritical of the men, acted in such a way that he antagonized the men and created dissension in the department, with a decided falling off in production. It finally became necessary to demote him from the foremanship. Immediately comes the question "why?" To answer this query would require considerable knowledge of the man. Possibly his developmental history led to a personality make-up which did not remain stable with an increase in authority. Maybe he had not developed sufficient judgment to see the foremanship in its proper perspective. A number of other possibilities might be mentioned. In any case, one wonders if this man could not have been saved to serve in a position for which he seemed so admirably fitted. It is my feeling that could have been done if he had been helped to see the underlying reasons for his behavior, and helped to eradicate it. This is a further task that psychology may undertake for industry.

Problems of personality maladjustment may occur in any employee, even to the major executives. In fact, they may be more frequent among executives and office workers than among the workmen. Case reports of such maladjustments have appeared in the literature for a number of years. They include such divergent conditions as a mild, temporary inability due to unhappy marital conditions or financial worries, to the development of psychoses following a series of real or imagined reverses. One man withdrew from social contacts, at the expense of his position, because of a conflict between his desire to marry and his belief that he was not in a financial position to do so. Another man gave up his interesting and secure position as a draftsman to follow the will-o'-the-wisp offered by a "character analyst." Study of such cases shows that maladjustments of several sorts—withdrawing from social contacts, feelings of inferiority, domination of and antagonism toward co-workers, suspiciousness, delusions of persecution, and so on—are the results of many varied and complex factors in the home, business, or social life of the sufferer. Psychology has developed methods of clinical study of such problems aimed at their exposition and ultimate correction.

A few places have been mentioned where psychology has a contribution to the problems of industrial personnel, but industry must not expect too much. Psychology has had relatively few opportunities to show what its value might be. In almost every case where trained psychologists have worked in industry they have made an economically valuable contribution. The term "trained psychologist" has been used because even business men have accepted the service (and paid for it) of so-called psychologists who are no more nor less than charlatans. Every professional psychologist has had requests to evaluate the offerings of this or that self-styled psychologist who is offering to build up personality, or to teach the executive how to select men by hair color or nose size, or how to do a number of equally improbable things. No plant manager would have a chemist who could not give an adequate account of his training. Yet this same man, his wife, and their neighbors will invest in the effusions of a man with an imposing list of degrees not to be found in the roster of any legitimate university. Dorothy Yates in her *Psychological Racketeers* has exposed this profession in an amusing style. Among other things, she tried to secure information from a number of such men regarding their training. Only one had any academic degree and that was not based on work in psychology. For his own protection no executive ever should engage anyone for psychological work without seeing the same credentials he would for any other scientific worker.

Scientific knowledge of human behavior is desirable not only for more satisfactory dealing with industrial personnel, but also for extra-mural human contacts. The product of every plant, be it paper, breakfast food, or farm machinery must be sold; and things can be sold only to humans. A million-dollar corporation may pay for an article, but some individual in the organization has had to be convinced of the necessity of the purchase and has had to decide to buy. Thus it would appear that any knowledge which facilitates selling has a definite usefulness.

Man has been buying, selling, and bartering through personal contact for thousands of years. Advertising of a crude sort was known to the Greeks and Romans. The development of advertising and selling methods has accompanied, if not led, the growth of modern industry. But, the reader asks, if advertising and selling have been successful, what need have we of the psychologist? Similar questions were probably asked when Perkins pointed the way to coal-tar dyes, or when the Fourdrinier Brothers promoted the development of the paper machine. And the answer today is the same: Scientific methods hold the promise of being more efficient and more economical than those by rule of thumb.

For illustration, consider printed advertising. Conceivably every individual is a potential buyer of every product. But whether or not he will buy depends on his needs, desires, ability to pay, knowledge and so on. Men on relief are not in the market for yachts, nor are millionaires ordinarily interested in the weekly A & P sale. Thus a very large section of the hypothetical market is eliminated by purely extra-personal, economic conditions. For the balance, the advertiser must recognize their motives and drives, their needs and desires, the possibility of modifying these, and the most efficient methods of appealing to them. Such appeals must vary with the product and the audience addressed. To the study of human motives, their control and utilization, psychology can make an important contribution.

Advertising, however, must do more than appeal in such a way that the reader's need is met. It must attract attention, arouse a pleasant feeling tone and not antagonize; it must be understandable and not too technical or too erudite for the reader; it must be readable and legible, and so on. In all of these the human element looms large, and psychology offers methods and data for dealing with the behavioral aspects of this human factor.

The behavior of the salesman in his contact with a buyer, and of the buyer when confronted by a salesman also have been studied by psychology. The radio has introduced new problems in the field of advertising, and psychology has begun to attack some of these. This phase of the subject should not be misunderstood. Psychology does not guarantee solution of all the human problems in industry, but it does offer a great deal of help. Judging from the debt of industry to other sciences, in the long run this help may prove most economically useful.

As this article is only suggestive, some readers may be interested in learning more about what has been done by psychology in the fields mentioned. M. S. Viteles' *Industrial Psychology* (W. W. Norton & Co., 1932) gives exhaustive summary of psychological research in all phases of industrial personnel. A similar summary of the literature in the application of psychology to advertising has been written by A. T. Poffenberger and published in 1932 by McGraw-Hill as *Psychology in Advertising*.

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Fiber Building Boards . . . their Manufacture and Use

The importance of the fiber building board industry is indicated in an article in the August, 1935 number of *Industrial and Engineering Chemistry* by C. G. Weber of the National Bureau of Standards. The boards are made largely from crudely-refined vegetable fibers from extracted sugar cane, saw-mill waste, straws, cornstalks, grasses, extracted licorice roots, tobacco stems, waste papers, bark and other similar materials, and it is of particular interest that this list of fibrous raw materials is comprised largely of farm crop and industrial wastes.

The raw materials are softened for pulping by digesting in dilute acid or alkali or water under pressure, and the boards are formed on modified papermaking machines in continuous sheets which are dried over hot rolls or between heated platens. Moisture resistance is obtained by incorporating sodium resinate or waxes or by water-resistant surface coatings. Fiber board is used widely in home construction in walls, roofs, attic floors and basement ceilings as heat insulation and in place of lath and plaster. In factories and office buildings it is used extensively for roof insulation. Acoustic boards which are essentially heat insulating boards with special surface modifications to increase sound absorption are coming into use as inside wall covering for theaters, auditoriums, schools and churches.

Starch and Dextrin Adhesives

FRED HOLT, JR., Technical Director
Brown-Bridge Mills

STARCH is one of the most universally used materials. As a filler, sizing agent and binder it has been known for centuries. Fortunately, it is available in large quantities at a low cost so that we always have been anxious to take advantage of its properties wherever possible, with the result that there are few products made that it is not used in some stage of manufacture.

Starch adhesives are generally called "vegetable" adhesives because the source is either the cereal grains or the roots of other plants. There are certain natural gums which also might be called vegetable adhesives but since their uses and properties are so different the term generally is not applied to them.

The United States uses more starch from corn than from any other source. The starch is small grained, has rather poor adhesive qualities and is inferior to tapioca or sago. But because of its very low cost it is used satisfactorily in many operations where these deficiencies are not prohibitive. Tapioca starch is used the most widely for adhesive purposes. It is separated from the roots of the Cassava plant of Java. The granule is large, the adhesive properties high. It has an agreeable color, odor and taste, and can be used on food products or where the tongue will come in contact with the adhesive. Potato starch is used a great deal in Europe because of the low cost of potatoes there. It forms a very high quality starch but retains an odor and taste of potato that is distinctly disagreeable. For this reason it has not found much favor in the United States. Sago starch is used somewhat in the textile industry for an effect which it alone has on the feel of the textiles. It has not been used in large quantities, however, because it is only recently that it could be freed completely from the foreign matter.

History of Starch and Dextrin

We find the earliest proof of the use of starch in the pieces of Egyptian papyrus in which the bundles of fibers were banded together with a starch adhesive. This dates to about 3500 B. C.

Pliny (70 A. D.) described the surface coating of papyrus with a starch paste made by boiling wheat flour with vinegar. Again, a Chinese document of 312 A. D. was sized with starch.

Between this time and the fifteenth century the use of starches seems to have been abandoned. Then descriptions of starch adhesives have been found dating 1700. By this time raw starch was being used extensively as a powder for wigs.

It is claimed that the dextrinizing of starch was accidentally discovered after a fire in a warehouse in Dublin, Ireland, in 1821. The great heat from the fire roasted the potato starch and the water used dissolved some of the converted starch forming a dextrin solution.

The last hundred years has seen tremendous expansion in the volume of raw and converted starch adhesives used.

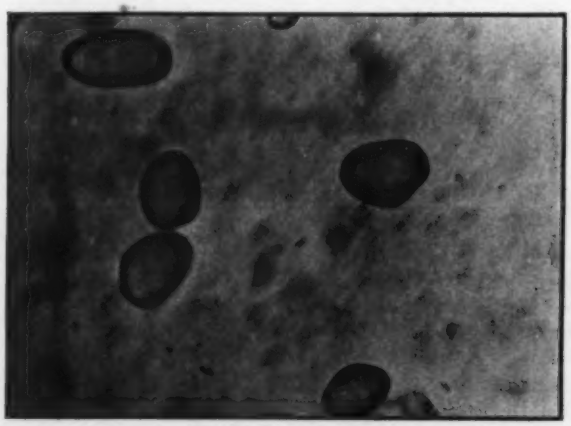
Chemistry

It is believed that starch is formed by the leucoplasts of the cell from soluble sugars in the absence of CO_2 and sunlight. The formula for starch may be written as $(C_6 H_{10} O_5)X$.

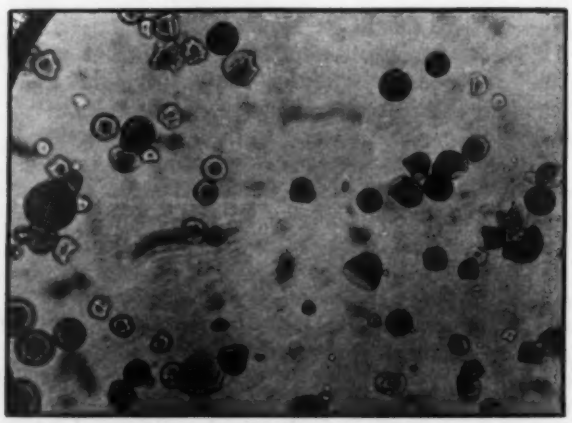
These groups represent residues of d-glucose. Since the decomposition of starch evidently causes atomic transformations, we are not sure just how these glucose groups are attached to one another.

The starch granule is made up of two materials. The outer shell is composed of "amylopectin" insoluble in cold water. The inner substance is "amylose" soluble in cold water. The size and shape of the granules vary with the source of the starch. The largest are about 60μ (sago, potato and tapioca). The smallest 15μ (rice and oat).

When the starch is boiled in water the granules swell and burst. When the outer sac breaks the amylose exudes and forms a colloidal solution. The empty sacs do not dissolve but become gelatinous and float around in the solution increasing the viscosity. Since the sacs



Potato starch cells



Tapioca cells, broken and unbroken

are mechanically weak, agitation will break them into bits and decrease the viscosity appreciably. After the sacs have been broken up thoroughly, the viscosity will remain constant at that temperature. When the temperature is lowered the viscosity will increase and some of the starch will precipitate.

Starch hydrolyzes easily under the action of

1. Boiling with dilute, $H_2 SO_4$
2. Moderate heat
3. Enyzmes

The hydrolysis brings about a breakdown of the molecule yielding dextrose as the end product.

Starch ⟶ Soluble starch ⟶ Amylo dextrin ⟶ Erythro dextrin ⟶ Achroo dextrin ⟶ Dextrose

Starch, soluble starch and amylo dextrin yield a blue color with iodine. Erythro dextrin gives a red color and achroo dextrin no color with iodine.

When hydrolysis occurs, it is agreed that the molecular aggregate of the amylose is reduced, making the solution less viscous. There is no chemical change in the amylopectin. Starch can be hydrolyzed so that the amylopectin will be changed chemically. These solutions are different from the thin boiling starch solutions. There is a better colloidal dispersion and the solution is permanent. That is, there is no precipitation as when ordinary starch solutions are cooled.

Enzymatic hydrolysis yields maltose as the end product instead of dextrose. There are several different enzymatic materials that will hydrolyze starch. Most of them are sold under trade names which do not reveal the source. Diastase, a malt enzyme causes a saccharification of starch yielding maltose and malto-dextrines. The juice from the pancreatic glands is another widely used enzyme for this purpose. Mould enzymes are also being used to bring about the hydrolysis.

As has been discussed, the action of acids is to hydrolyze the starch. Alkali causes the granule to swell and burst forming a clear jelly. This jelly is often used as an adhesive or is neutralized and then is used as an adhesive. Oxidizing agents yield soluble starches free from dextrin and sugars. Permanganate, hypochlorite, etc., may be used. Borax increases the solubility in cold water and exerts a stiffening action. Certain salts such as chloral hydrate, calcium chloride and potassium acetate act similar to alkali and cause a gelation of the starch. Starch acetate (Feculose) is soluble in water and yields an elastic film. The product can be varied by changing the acetic acid concentration and cooking time. The structure of starch has been mentioned as $(C_6 H_{10} O_5)X$. The structure and size of molecule is a matter of discussion. There are several theories each having some basis, each having contradictions. It is interesting to note that recent X-ray studies show that starch, like cellulose, is not amorphous, but crystalline; that it consists of very small anisotropic crystals; that the structure of many starches are all the same; that the cell of starch cannot hold many glucose radicals and therefore must have a low molecular weight.

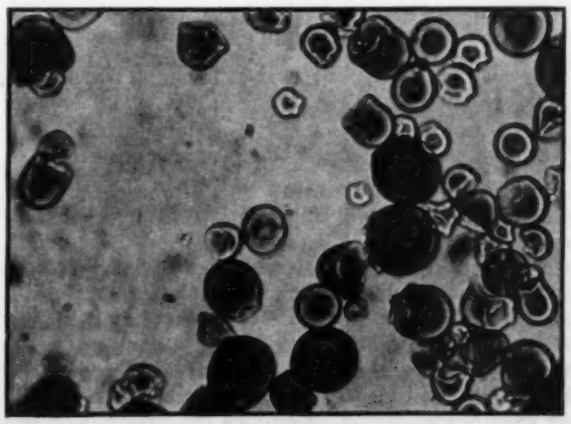
Manufacture of Starch

The process is entirely one of separation of the undesirable portions of the plant from the starch. The starch is present at the very start in the form in which it is desired. The processes for different kinds of starch vary only to take care of special conditions imposed by the source. Let us consider the manufacture of corn starch, and then show the differences for potato and tapioca starches.

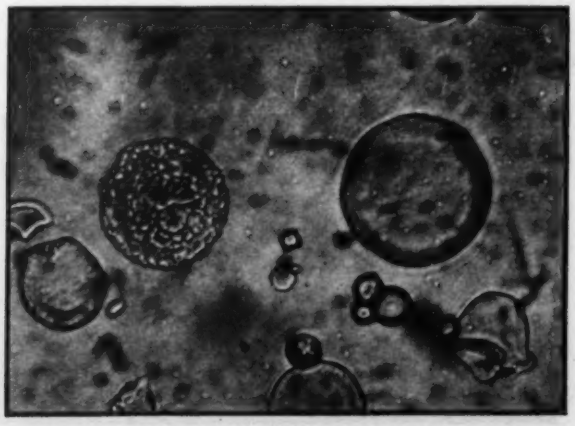
The first step is to clean the grain and remove chaff. The grain is then steeped for 2 or 3 days in acidulated water at a temperature of 110 to 125 deg. Fahr. This softens the corn but does not affect the starch. The kernels are next cracked in mills and the material is sieved through a 200 mesh cloth. This removes the cellulose leaving the starch and gluten. A weak suspension of the sieved material is run down very slightly inclined tables. The starch settles to the bottom and the gluten passes off in the water. Sometimes this tabling is repeated to purify the starch further. The wet starch is then spread on trays and dried in tunnels.

The practice now with potato starch is to centrifuge it rather than to table it. The rest of the process is practically the same.

Tapioca starch is prepared from the roots of the Mannioc or Cassava plant. The world's commercial supply comes from the Island of Java. The roots are best when two years old. They must be ground fresh to prevent any deterioration. The process is essentially the same as for corn starch. Drying is done by centrifuge. The flour is shipped to the United States for conversion.



Tapioca cells—some ruptured



Broken, badly-dried tapioca starch

Starch Adhesives

Raw Starches—The raw starches make stiff pastes at low concentrations. It may require 8 to 10 parts water for one part of starch to produce a suitable fluidity. Consequently, there is a tremendous shrinkage on drying and a weak bond to the material with which it is used. Starches are used in this manner for filling, sizing, printing, etc.

Soluble Starches—These differ from the raw starches in that they require much less water to make a workable solution. These are the thin boiling starches. The solution is nearer to being truly colloidal and yields a much stronger film. These are used extensively for sizings of paper and textiles, combinings and laundry starch.

Pastes—These cover a wide range of products. Everything from raw to highly converted starches is used. Some are single products, some are mixtures. Many non-starch materials are added to serve different purposes. Gums, animal or fish glues, borax, alkali, silicate of soda, resins, etc., are mixed in to give special properties. These pastes are used on innumerable materials. Library, household, paper bag, paper combining and textile uses are only a few of the many.

Dextrins—These are the most highly converted adhesive products of the starch group. They form true colloidal solutions; they require only one part of water to one part of dry dextrin to make a fluid solution. They dry to clear, bright, flexible, very adhesive films and are used as adhesives where these properties are essential. The gumming and envelope industries use these dextrins. They are used in the textile finishing plants for printing pastes, etc.

Manufacture of Dextrin—There are two general methods for converting starch into dextrins. One is called the dry process, the other the wet process. The commercial method is to roast a continuous layer of starch at 200 to 400 deg. Fahr. which has been moistened with a volatile acid, generally a mineral acid. This acid hydrolysis converts the ray starch to a mixture of the amylo, erythro and achroo dextrins with a little dextrose. The great difficulty is to keep the product absolutely uniform from day to day. Shipments of the raw starch are not uniform due to the differences of the conditions under which the starch was formed in the plant. The age of the plants, the changes in weather conditions during growing, all affect the starch so that the shipments require changes in the temperature of roasting and the amount of acid to yield a uniform dextrin. The control system for this process is very elaborate and allows the process of conversion to be stopped at exactly the right moment. This is done by quickly lowering the temperature by blasts of cold air. The volatile acid is quickly used up so there is no free acid in the dextrin. The dextrin is then ready for bagging.

Treated starch entering dextrin machine

The wet process consists of treating a suspension of starch in water with acid or enzyme until it is converted, then evaporating the water. This is not used commercially to any great extent.

By this process, starch can be obtained in many stages of conversion. There are, however, only three general classes of dextrins being used. In each class, of course, there are several products varying slightly from each other to suit the different needs of the customers.

One class is known as the British Gums. This is a dextrin with a very high viscosity. If any raw starch is left in the dextrin it will form a non-flowing paste. It is converted at a very high temperature, about 400 deg. Fahr. with little or no acid. The color is darker than for the other dextrins. Sometimes a mixture of different starches is used so as to give the proper fluidity, color, adhesiveness, etc. It is used mostly as a thickener for textile printing colors.

The second class is the envelope gums. This stands between the regular dextrins and the British gums. It is converted at a lower temperature with more acid than the British gums and has a lower viscosity and lighter color. The use is for envelopes, where adhesiveness, odor, color and non-washing properites are important.

The regular dextrins are close to the envelope gums and the two are sometimes used interchangeably. In general, the regular dextrins are lighter in color and less viscous. They are made at a still lower temperature and with still more acid than the envelope gums.

Analysis

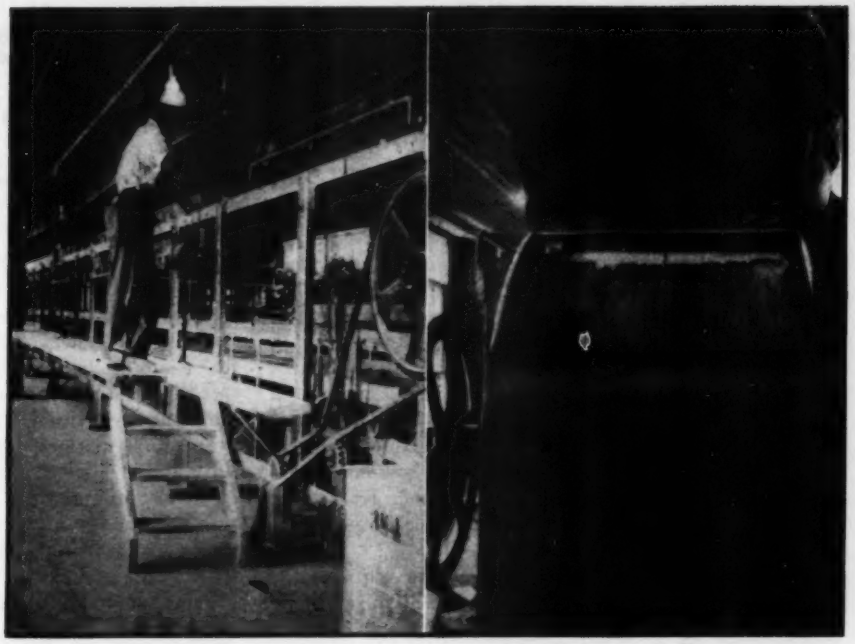
In order to grade these gums, dextrins, etc., a series of tests is used. In addition to these tests special tests are generally made to determine the fitness of the product for a particular use. The basic analytical tests are as follows:

1. Viscosity
2. pH
3. Ash
4. Color
5. Odor
6. Reducing Sugars
7. Cold Water Soluble
8. Adulterants
9. Moisture
10. Micro Examination
11. Uniformity

Special tests, any one of which might assume tremendous importance for some one use, are as follows:

1. Clear Film
2. Adhesion
3. Borax
4. Oxidizing or reducing substances
5. Speed of drying
6. Reactions on colored materials
7. Hygroscopicity

The viscosity of a starch solution affects the machining qualities of the material. For any one grade it should be kept constant in order to insure an even, constant coat and to allow the drying operations to give uniform results. A change in the viscosity indicates a change in the conversion, a difference in the amount of unconverted starch, if any, or the presence or lack of any foreign material. The temperature must be



Left—View of starch converter

Right—Finished dextrin being discharged

controlled carefully during this test as the viscosity changes over a wide range with a small change in temperature.

Starch solutions have a normal pH range. The material should be tested to be sure that it is within these limits. Careless manufacture might leave free acid in the starch or adulterants may have been added.

A good starch has a very low ash, only 0.2 or 0.3 per cent. Addition of adulterants, or the use of a low grade starch, generally will increase the ash considerably.

Unconverted starch suspensions are milk white. The converted products yield solutions from almost water white to a caramel color. It is important to standardize on a single color for uniform results. The color has no relation to the quality of the product. A good many of the converted starches are artificially colored to meet the customer's standard.

An analysis should include a quantitative measure of the reducing sugars present. This percentage indicates the care used in the manufacture, and the hygroscopicity of the material. A large amount of reducing sugar indicates over-conversion, poor adhesiveness, and a high susceptibility to moisture. A rigid standard should be set up for this test.

The amount of unconverted starch is indicated by the cold water soluble test. This, combined with the reducing sugar test, enables one to watch the uniformity of the conversion very well.

It is not uncommon to find other materials besides starch in the adhesive materials. These may be necessary to give some particular property to the product. Their presence should be understood, however, and anything else questioned.

Starches are hygroscopic so it is not unusual to find 10 per cent moisture. This is no reflection on the quality, but the moisture content always should be considered when making up the solution in order to keep the viscosity constant.

It is always advisable to make a microscopic examination to make certain the particular starch or mixture specified or advertised is being obtained.

Due to the extreme difficulty of obtaining real uniformity from shipment to shipment, tests should be made against a standard sample. This is always a selling point and often causes the greatest trouble experienced with a product.

The special tests generally are made with homemade apparatus and are important only to a particular user. Nevertheless, these often are ultimately more essential than any of the others.

Use of Starch in the Paper Industry

The tendency in the past has been to use raw starches. Experience has shown that the best results are obtained with those converted starches which form a true colloidal solution.

When unmodified starch is used in beater sizing it covers only a small area of the fiber and a great deal of the starch is lost on the wire. A soluble starch covers the fiber better and shows a better retention. If added before the rosin it acts as a protective colloid and allows the rosin to be precipitated in much finer grains by the alum, increasing the sizing effect. Also, a decided decrease in rosin spots in the sheet is noticed. Clay retention can be increased by adding some of the starch solution to the clay before it is dumped into the pulp.

The more truly soluble the starch, the greater will be its effect. Not only will the surface area which it covers be greatly increased but there will be a stronger bond between the fibers than there would be with a raw starch. The soluble starch during drying will travel to the surface of the sheet and make a better finish than raw starch.

For top sizing the soluble starches should be used. A smoother, more effective film is formed than with the unconverted granules.

Lighting Performance Audit

Assures Highest Return on Investment

WALTER W. WILDEMAN, Illuminating Engineer
Westinghouse Lamp Company

FOR many years, correct industrial lighting met its greatest obstacle in the failure of factory executives to tender it proper respect. Electric lighting was regarded as a necessary evil to be tolerated only so long as daylight remained away. Lamp bulbs were hung any old place the spirit moved without a thought of efficient arrangement. Now, of course, all industries recognize the social and economic necessity of correct lighting. Yet it is surprising how many factories and mills install modern lighting then let it lapse into the "red." Such lighting can be a millstone around the neck of manufacturing costs.

The performance of a lighting system requires the same attention as any other unit in the manufacturing picture. Granted that the system is modern, the aim is to keep it as near as possible to its original efficiency. On a comparison basis, the lighting system really should command greater attention than a manufacturing procedure because the efficiency of all manufacturing is affected by the nature of the lighting. The actual cost of lighting, or the return on the money it represents, is a direct factor of maintenance.

Network Fundamentals

Like the human body, the efficiency of a lighting system is a factor of its network function. Where blood circulation keeps people on their toes, the wiring and voltage are fundamentally responsible for the pep of a lighting system. Their regularity is the key to the efficiency and economy.

Whether a plant generates its own power or receives it from utility lines, the voltage should remain constant at the socket. Supplying power at a constant voltage is comparatively simple. Even in a good system an inevitable voltage drop of 2.5 volts is recognized. In the main, this may be counterbalanced by providing a slightly excess voltage at the service entrance of the distribution panel. The discrepancy usually occurs in the wiring. Either runs are too long, the wire too small for the load, or power and lighting load are taken from the same lines to result in frequent variations.

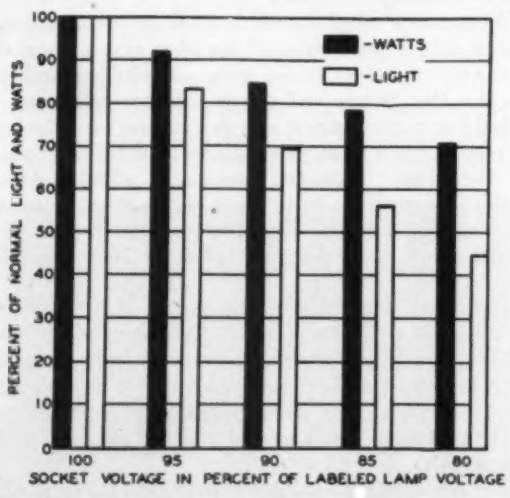


Fig. 1—Burning lamps below rated voltage increases cost of light actually received

Mazda lamps are designed to operate most economically and efficiently at their designed, or rated, voltage. A survey will disclose socket voltage and in turn, dictate the voltage of lamp to use. If the voltage at the socket ranges from 113 to 117, use 115 volt lamps; if betwen 118 and 122 v. use 120 volt lamps.

Long runs or undersize wire may be the cause of an excessive voltage drop that is operating the lamps below voltage. The light output of these lamps drops faster than the wattage (Fig. 1). A one per cent drop in socket voltage will produce a 3 per cent loss in light output. Under the same conditions, wattage is reduced only 1½ per cent. Burning lamps under voltage is a costly practice since it only increases the cost of the actual light received on the working plane. Obviously, the sometimes indulged practice of burning lamps below voltage to save wattage and lamp costs is "penny wise and pound foolish."

Where wiring was once installed primarily for safety against fire, now it is installed for adequacy. It is important to know that wiring which conforms to the National Electrical Code, by which fire underwriters establish insurance rates, does not always measure up to adequacy requirements.

Wire no smaller than No. 12 should be used for branch circuits, either from panelboard to first outlet or between outlets. Runs of 50 to 100 feet from panelboard to first outlet, require at least No. 10 wire with no smaller than No. 12 between outlets. Avoid runs of more than 100 feet between panelboard and first outlet by the addition or relocation of panelboards.

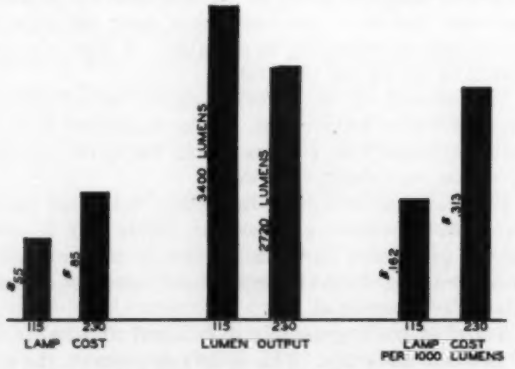


Fig. 3—The performance of a 200-watt PS-30 bulb, general service lamp at 115 and 230 volts, respectively, shows that low voltage lighting is cheaper

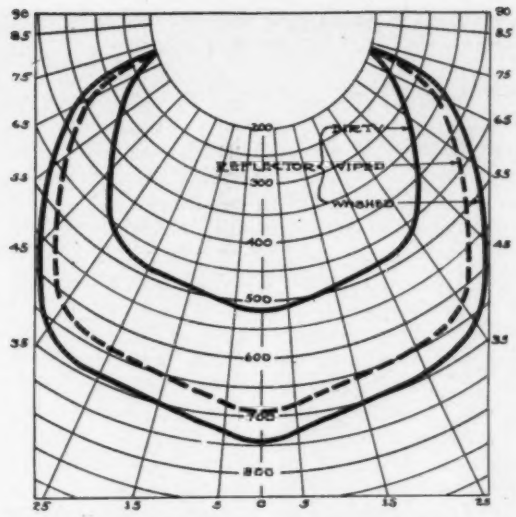


Fig. 4—Actual performance of a single RLM industrial reflector, as indicated by distribution curves, shows how maintenance can improve lighting

Feeders should be of such size that the voltage drop from the source of supply to the panelboard will not exceed 1½ per cent with all branch circuits fully loaded. In the accompanying table (Fig. 2) are found the branch circuit and feeder wire sizes for various lengths of runs with various loads from 5 to 120 amps.

Lighting circuits for fixed lights should never serve outlets for power loads. If the circuits are of 15 ampere capacity, they should be provided in sufficient number so that the initial load shall not exceed 1000 watts, except when the circuit serves a single lamp of larger size. Convenient outlet circuits should be plentiful enough in order that the total initial load likely to be connected to any single circuit is less than its designed capacity.

Selecting the Lamp

With proper power supply and wire sizes assuring steady voltage at the socket, the next step is to select lamps of that voltage. Incidentally, one should try to get 115 rather than 230 volts at the socket because, in the long run, lamp replacements will be cheaper.

The increased cost of 230 volt lighting over 115 volt for a 200 watt, PS-30, general service lamp is 93.2 per cent (Fig. 3). This increased cost varies with the various size of lamps but in general the 230 volt lighting is much more costly.

The kind of lamp to use is also important. Out of the some 3,000 different kinds of incandescent lamps manufactured today, no more than half a dozen or so need come under the jurisdiction of the plant electrician. All standard lamps up to, and including, 100 watts are supplied with inside frosted bulbs. Higher wattages are ordinarily supplied with clear bulbs but may be obtained on special order with inside frosted, white bowl or daylight blue bulbs.

The white bowl lamp is made in sizes ranging from 150 watts upward. The white coating conceals the filament and minimizes its glare in open type reflectors. It is recommended for low mounting heights where the brilliant filament glare may disturb vision. Obviously, reflectors mounted more than 12 feet above the floor do not come within this classification.

Based on { Two Per cent Loss in Voltage on 110-volt, 2-wire circuits.
One Per cent Loss in Voltage on 220-volt, 2-wire circuits.
One Per cent Loss in Voltage on 110/220-volt, 3-wire circuits.

On short runs, where voltage drop does not affect wire size, the table shows minimum permissible commercial size Brown & Sharpe gauge rubber covered copper wire according to the National Electrical Code.

Amp. Load	Length of Run in Feet																	
	30	40	50	60	70	80	90	100	120	140	160	180	200	240	280	320	360	400
5	14	14	14	14	14	14	12	12	12	10	10	10	10	8	8	8	6	6
6	14	14	14	14	14	12	12	12	10	10	10	8	8	8	8	6	6	6
7	14	14	14	14	12	12	12	10	10	10	8	8	8	6	6	6	6	4
8	14	14	14	12	12	12	10	10	10	8	8	8	8	6	6	6	4	4
9	14	14	12	12	12	10	10	10	8	8	8	8	6	6	6	4	4	4
10	14	14	12	12	10	10	10	10	8	8	8	6	6	6	4	4	4	4
12	14	12	12	10	10	10	8	8	8	8	6	6	6	4	4	4	4	2
14	14	12	10	10	10	8	8	8	6	6	6	6	4	4	4	2	2	2
16	12	12	10	10	8	8	8	8	6	6	6	4	4	4	2	2	2	2
18	12	10	10	8	8	8	8	6	6	6	4	4	4	4	2	2	2	1
20	12	10	10	8	8	8	6	6	6	4	4	4	4	2	2	2	1	1
25	10	10	8	8	6	6	6	6	4	4	4	2	2	2	1	1	0	0
30	8	8	8	6	6	6	6	4	4	4	2	2	2	1	1	0	0	00
35	8	8	6	6	6	4	4	4	4	2	2	2	1	1	0	00	00	000
40	6	6	6	6	4	4	4	4	2	2	2	1	1	0	00	00	000	000
45	6	6	6	6	4	4	4	2	2	2	1	1	0	00	00	000	000	4/0
50	6	6	6	4	4	4	2	2	2	1	1	0	0	00	000	000	4/0	4/0
60	4	4	4	4	4	2	2	2	1	1	0	0	00	000	000	4/0	4/0	
70	4	4	4	4	2	2	2	1	1	0	00	00	000	000	4/0	4/0		
80	2	2	2	2	2	2	1	1	0	00	00	000	000	4/0	4/0			
90	2	2	2	2	2	1	1	0	00	00	000	000	4/0	4/0				
100	1	1	1	1	1	1	0	0	00	000	000	4/0	4/0					
120	0	0	0	0	0	0	0	00	00	000	4/0	4/0						

NOTE: For good voltage regulation design feeders for a maximum of 1 per cent voltage drop, branch circuits for a maximum of 2 per cent voltage drop.

Where wire larger than No. 10 is required to eliminate excessive voltage drop on branch circuits, split the circuits, or move the panel board closer to the load center.

Fig. 2—Branch circuit and feeder wire sizes for loading of 5 to 120 amperes for various lengths of run

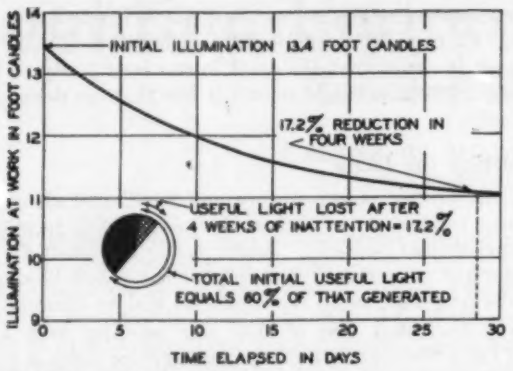

INITIAL ILLUMINATION 13.4 FOOT CANDLES
17.2% REDUCTION IN FOUR WEEKS
USEFUL LIGHT LOST AFTER 4 WEEKS OF INATTENTION = 17.2%
TOTAL INITIAL USEFUL LIGHT EQUALS 60% OF THAT GENERATED
ILLUMINATION AT WORK IN FOOT CANDLES
TIME ELAPSED IN DAYS

Fig. 5—Effect of dirt on the efficiency of a lighting system

Daylight blue lamps filter out some of the red and yellow rays to produce a whiter light that resembles the color of daylight. From an economical standpoint, however, daylight blue lamps are seldom used, except for special applications where color matching is paramount. To use them for general illumination results in high operating costs because the daylight blue glass absorbs approximately 35 per cent of the generated light. Thus, for a specific level of illumination in the working area, higher wattage lamps would be required to compensate for the loss of light by absorption.

Another important factor in the selection of the lamp is its size relative to the reflector. If the wrong size of bulb is inserted in a reflector, the distribution of emitted light is changed with a corresponding loss in lighting effectiveness. For example, a 200 watt size of RLM reflector with a lamp of corresponding wattage will emit light with an output efficiency of about 73.5 per cent. If a 150 watt lamp is used in the same reflector, the output efficiency drops to about 62 per cent. One of the best checks on this loss is a study of the proper reflector holder, or of the socket position therein, and to guard against the careless interchange of bulbs and accessories.

Water Cheaper Than Watts

Of all the factors in lighting maintenance, that of dirt is probably the most common, if not the worst. But it is also the easiest to rectify. A little soap and water, or even a dry cloth, will do wonders. No one will deny that water is cheaper than watts, but on almost every hand one can find a thoroughly modern lighting system struggling to send forth adequate light through a film of dust and dirt.

Many commonplace examples exist to demonstrate the importance of removing film from lighting units.

Let us look at the actual performance of a single RLM-reflector in an industrial plant (Fig. 4). A film of dirt and grease had become so thick that only 500 candlepower of light was emanating from the fixture. Then it was wiped clean with a dry cloth. The light output jumped to 700 candlepower. Later on, soap and water were applied and the candlepower output moved up to 800.

The loss of light from dirt and dust is a serious proposition in a large lighting system. (Fig. 5). One installation had an initial illumination of 13.4 footcandles. At the end of four weeks accumulated dirt brought this level down to 11 footcandles, or a drop of 17.2 per cent.

Cleaning Materials

In any discussion of economics, one naturally asks, "How should lighting equipment be cleaned and what does it cost?" General experience of past years has shown that bulbs and reflectors should be wiped free of dust at least once each month. Except in unusually dirty locations they should be washed at least once every 60 days. It is not a bad plan to alternate dry and wet cleaning.

Stubborn cases of encrusted greasy dirt require warm water and soap or a mild grease solvent. Extreme cases of hardened sooty deposits, particularly on outdoor equipment, may require a dilute solution of oxalic acid. Another wet solution for cleaning is trisodium-phosphate. After the common washing with soap and water, rinse the reflector in ammonia water (a pint to a bucket) then wipe and dry it thoroughly so as to avoid a possible soapy film that gathers dust quickly.

Cleaning costs vary, but taken alone they seem to average in the neighborhood of 4 per cent of the total operating costs of a lighting installation. If, as seems evident, such a cleaning will in itself increase the illumination 20 to 25 per cent, then the results pay for the expenditure four or five times.

The frequency of cleaning will, in the end, depend upon air conditions in the working area. Fixtures which are exposed to heavy fumes and dust, will naturally require more frequent attention than those in rooms where the dust is light. In one plant, the practice is to let the average initial illumination in a bay represent 100 per cent and when the illumination drops below 90 per cent, it is time to clean the fixtures. At the outset it would be necessary to make actual footcandle readings, but eventually the period of cleaning could be placed on a monthly or weekly basis, which-

Fig. 6—Safe-change hanger facilitates safe and easy removal of lighting fixtures for cleaning purposes

Fig. 10—A new "vest-pocket" light meter enables plant electrician to check lighting on spur of the moment or to keep tab on maintenance schedules

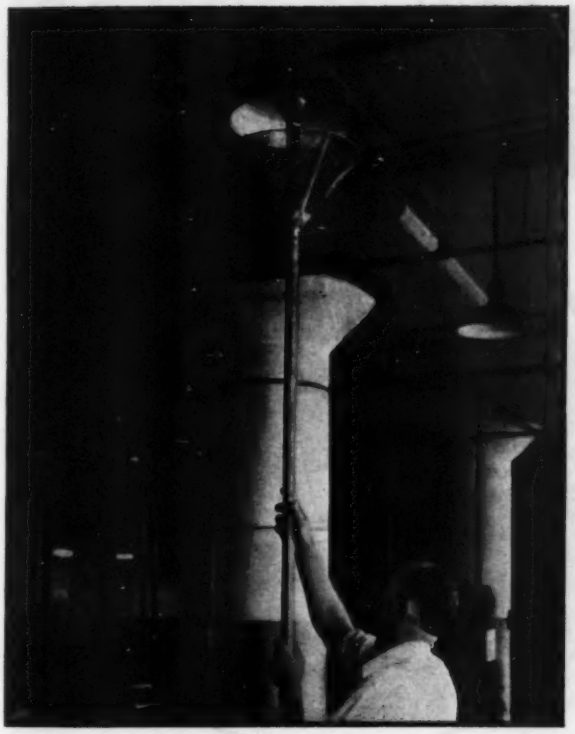


Fig. 7—A lamp replacement pole with funnel-shaped piece of fine mesh screen around top for protection of maintenance man from falling glass

ever the conditions decree. But even where the industrial activity does not warrant systematic lamp replacements and cleaning, at least there should be an arrangement whereby every time a lamp is replaced that fixture is cleaned.

Facilitating the Cleaning Job

The accessibility of the lighting unit and of the lamp is important to the ease of maintenance. In industrial installations, the "safe-change" hanger facilitates removal of both reflector and lamp to the floor for washing (Fig. 6). It is much simpler and safer than cleaning fixtures on top of a ladder.

The safe change hanger, however, is generally used with industrial type units, especially desirable with the Glassteel fixture where cleaning entails the removal of a globe. The repair man simply mounts a ladder and replaces the dirty fixture with a clean one. Once down again, he cleans the unit and hangs it in place of the next dirty one. With RLM fixtures, however, and in a comparatively clean working atmosphere, dry cleaning is of course more systematic by simply mounting a ladder.

Where lamp replacements are made spasmodically as they burn out or at a different time than the cleaning schedules, they may be removed and replaced from the floor by use of a pole and prong. Lamp bases sometimes corrode and the bulb may burst under the pressure of twisting during the removal. One way to safeguard the worker against possible falling glass is to build a funnel-shaped piece of fine mesh screen around the top of the pole (Fig. 7). Otherwise goggles should be used, except that, while they protect the eyes, the face may be cut.

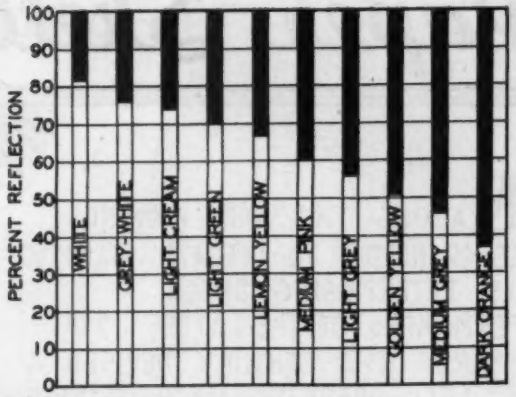


Fig. 8—Colors figure differently in their general effect on industrial lighting

Wall Coatings

What we have discussed about dirt on the reflector applies in principle to grimy or discolored interior surfaces of the working area. Various colors are characterized by different coefficients of reflection (Fig. 8). Theoretically, if the reflection coefficient of the interior is doubled, the illumination is increased by three and four times.

If walls and ceilings are to reflect the maximum amount of light that strikes them, they must be coated with light colored paints. It is obvious that paint and light are inter-dependent. The color of surroundings has a marked influence on resultant illumination, not to mention the psychological effect upon employees. Dark colors absorb illumination, while light colors reflect it. Since, with any system of lighting, considerable light falls on the surrounding areas, it follows that only by making them as light as possible can the highest efficient of a lighting installation be assured. For the ceiling finish a good flat white paint is preferable. Glossy surfaces should be avoided because of the sheen caused by their reflected glare.

In the final analysis, the secret of an efficient lighting installation, after it has once been properly installed, lies in planned periodic attention (Fig. 9). Frequent light meter surveys are recommended in order to detect depreciation. (Fig. 10). Above all, maintenance must be made the regular duty of a reliable employee who is given to appreciate the worth of his job and for which he should be credited accordingly.

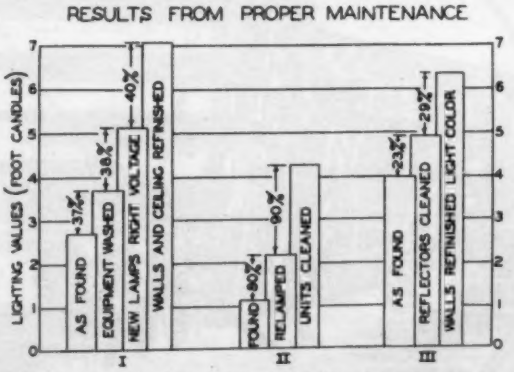
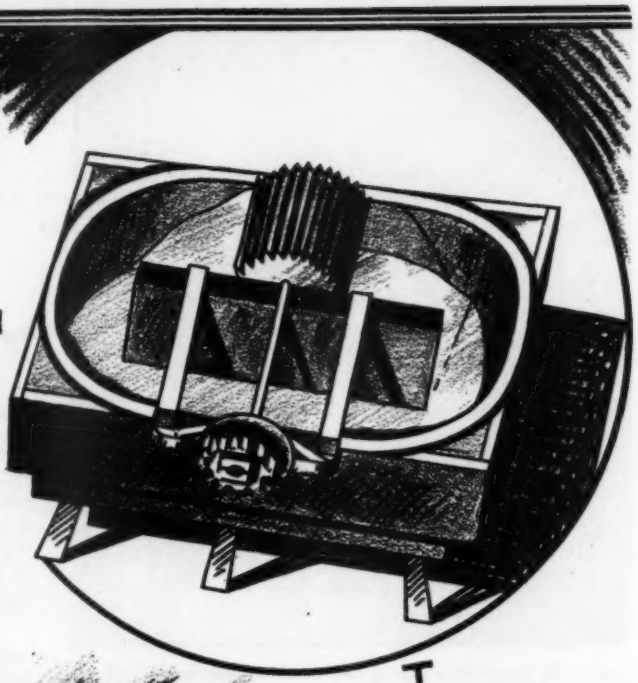


Fig. 9—The secret of an efficient lighting installation is periodic attention

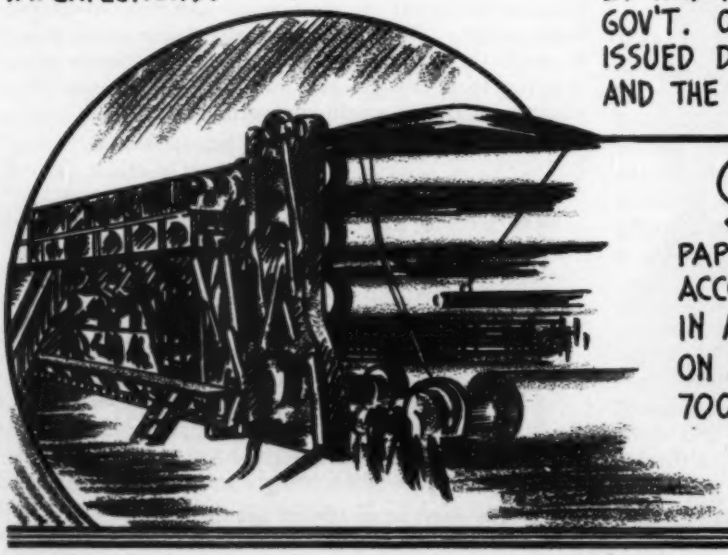
Paper Sketches ---



LACKING THE SWIFT-FLOWING STREAMS NEEDED TO OPERATE STAMPING MILLS, ENTERPRISING DUTCH PAPERMAKERS OF THE LATTER 17TH OR EARLY 18TH CENTURY DEVISED A WIND MILL OPERATED MACHINE KNOWN AS THE HOLLANDER FOR STOCK PREPARATION. THIS MACHINE REQUIRED SO LITTLE POWER THAT FIVE OR MORE OF THEM COULD BE OPERATED BY A SINGLE WATER-WHEEL.

ALTHOUGH FREQUENTLY OBLIGED TO PRINT ON TORN PAPER, NEWSPAPER PUBLISHERS OF COLONIAL DAYS REPAIRED DAMAGED SHEETS SO SKILLFULLY THAT EVEN TODAY CLOSE EXAMINATION OFTEN IS REQUIRED TO DETECT IMPERFECTIONS.

THE WILLCOX IVY MILL, BUILT DURING 1729 BY THOMAS WILLCOX IN CHESTER TOWNSHIP, PA., HAD ONLY 2 MANAGERS DURING ITS FIRST 98 YEARS--THE SON OF THE FOUNDER CONTINUED AS MILL MANAGER UNTIL 1827. IT WAS FROM THIS MILL THAT THE U.S. GOV'T. OBTAINED ALL CURRENCY PAPER ISSUED DURING BOTH THE REVOLUTION AND THE WAR OF 1812.



SO FAR AS IS KNOWN, DRYING PAPER IN A VACUUM FIRST WAS ACCOMPLISHED IN DECEMBER, 1926 IN A CANADIAN NEWS PRINT MILL ON A MACHINE RUNNING AT ABOUT 700 FEET PER MINUTE.

T.A.P.P.I. Fall Meeting at Atlantic City

Unusual program and entertainment arranged by Delaware Valley Section

Ambassador Hotel, Atlantic City, where the formal sessions of the T.A.P.P.I. meeting were held

SEPTEMBER 18, 19, 20 and 21 will be red letter days in the chronological listing of events covering the activities of the Technical Association of the Pulp and Paper Industry and particularly the activities of the Delaware Valley Section of T.A.P.P.I. On these days was held the twentieth annual fall meeting of the association; the Delaware Valley Section, a section only four years old, acting in the capacity of host.

What a genial host this Section proved to be! No effort seemingly was spared in the arrangement and carrying out of a most interesting program of fundamental and technological papers a program that was spiced with an abundance and yet not too much enjoyable entertainment and recreation.

The Day at Hercules

The meeting started off with finesse on Wednesday morning, September 18, with delegates and guests, who had assembled at Hotel Pennsylvania, Philadelphia, Pa., departing from there and traveling by special train to the laboratory of the Hercules Powder Company, Wilmington, Del. All delegates and guests of T.A.P.P.I. on this train were guests of the Hercules Powder Company and the Paper Makers Chemical Corporation—the train having been chartered by them for the occasion.

The train left the B. & O. station, Philadelphia, at 11:00 a. m. and arrived at the laboratory shortly after twelve noon. Every one aboard the train was entertained throughout the trip by "Uncle Charley," a character conceived by the Paper Makers Chemical Corporation, and his songsters.

At the laboratory, the guests of Hercules Powder and Paper Makers Chemical Corporation were arranged in small groups, each group being in charge of a group leader, for the purpose of making a trip through the Experiment Station. This method of handling the guests expedited the entire procedure and made it easy for each one making the trip to get the greatest good from it.

The Experiment Station occupies a commanding hilltop site on a plot of approximately 300 acres about five miles west of Wilmington. The plot is carefully landscaped and is set in restful surroundings of woods and fields and gentle hills—a vista that is unusually beautiful.

The station consists of a group of thirteen buildings; the central structure being a main laboratory building that is served by a group of semi-plant units, shops and smaller laboratories.

The main building exhibit schedule was arranged to include an opportunity to view the paper coating laboratory, an extensive photo and photomicrographic display, results of physical tests on protective coatings, the operation of a Mayer paper coating machine; papermaking size service; preparation of Tornesit, an orderless, white, fluffy material, produced by the chlorination of rubber and used as a protective coating base in paints; spinning machine for wet and dry spinning of rayon; strength of cellulose derivatives, and spectrograph analyses. In the semi-plant exhibit schedule opportunity was given to view a Chambers coating machine in operation lacquering paper; a semi-plant naval stores operation; plastic molding; and the explosives laboratory.

The visitors, each in their respective groups, moved along through the various laboratories with clocklike precision, absorbing as much as could be seen through visual observation, and asking pertinent questions for the acquirement of other information of those in charge of the various exhibits or of the guides. It is scarcely too much to suggest that this visit to the laboratory alone may result in a new vision and a new approach to at least one problem that has been baffling some worker and through it offer a way to solution.

The scheme utilized for the trip through the various laboratories permitted luncheon to be served to all guests at the Experiment Station dining room with the least possible delay. Some of the groups enjoyed their luncheon repast previous to their laboratory visitation; while the remaining groups found their way to the dining room immediately upon completing the trip about the Station.

With the program of the day at the Experiment Station completed, the convention delegates and guests of T.A.P.P.I. again boarded the special train which conveyed them to Atlantic City via North Philadelphia, at which point the ladies who had been sojourning for the day in Philadelphia joined the party. Uncle Charley and his trio were much in evidence throughout the entire trip and they did much to make the journey a pleasant one.

Surely, Hercules Powder Company and the Paper Makers Chemical Corporation are deserving of real praise for their contribution to the 1935 fall meeting of T.A.P.P.I. This contribution proved to be the detonator of a most successful four-day session.

A "How-dee-do Supper" was arranged on the evening of the first day in the Rainbow Grille of the Ambassador Hotel, the convention hotel in Atlantic City, for all those who had arrived on the special train or otherwise. Pleasing entertainment and dancing were the features of the supper program.

Formal Session Opens

The formal opening of the convention took place at approximately 9:30 a. m. on Thursday, September 19, in the Venetian Room of the Ambassador Hotel,

Group of T.A.P.P.I. delegates at Hercules Powder Experiment Station, Wilmington, Delaware

when the session was called to order and C. C. Heritage delivered his address of welcome.

In his remarks, Mr Heritage emphasized the national scope of the Association by citing the 1931 fall meeting at Kalamazoo, Mich., the 1932 meeting at Holyoke, Mass., the 1933 meeting at Appleton, Wis., the 1934 meeting at Portland, Ore., and the 1935 meeting at Atlantic City. He said that each member in attendance at the meetings had the opportunity of contributing his knowledge to the common good. He then commended the Delaware Valley Section of T.A.P.P.I. for its efforts in planning and arranging the convention, and suggested that at an executive committee meeting on the Tuesday previous in Philadelphia a modest sum of money had been appropriated for research. This money, Mr. Heritage stated, was in the hands of Dr. J. L. Parsons of the Hammermill Paper Company and his committee. In the opinion of Mr. Heritage, this appropriation of money for research is a milestone in the growth of the organization and that from now on members can see the association taking definite steps in the promotion of this work.

In continuing his remarks, Mr. Heritage mentioned the work of G. E. Landt, chairman of the 1935 fall meeting, and of his committee. Immediately following these remarks, Dr. Landt was introduced by Mr. Heritage and he proceeded as chairman of the session.

Dr. Landt told briefly of the philosophy employed in formulating the program; suggested that discussions often have a tendency to confuse rather than to clarify an issue; stated that basic assumptions are not always scrutinized with sufficient care; and reiterated that meetings sometimes become sounding boards rather than clear elucidations of questions at issue. In formulating the program, Dr. Landt stated that the increasing usefulness of T.A.P.P.I. meetings in clarifying questions that come up continually was set as an objective so that questions which might be debated interminably could be taken up one by one. He then turned his thoughts to those who had given of their time and effort with him in arranging the program; said that the several men merited praise for their efforts, and conveyed his thanks to them in words of appreciation.

Following these brief remarks, Dr. Landt introduced Dr. G. J. Ritter of the U. S. Forest Products Laboratory, who presented his paper on *The Morphology of the Cellulose Fibre*, the first of three papers of a symposium on *The Cellulose Fibre from the Standpoint of Paper and Pulp Manufacture.*

In part, Dr. Ritter stated that shape and structure are important properties to be considered in the evaluation of cellulose fibers for papermaking; that cellulose fibers utilized for paper are slender capsular-shaped bodies; that the average length of cotton, flax, and hemp fibers is about 35 mm. (approximately 1,200 times their average diameters), while the average length of hardwood fibers is 1 mm. and that of softwood 3 mm. (about 100 times their respective diameters); and that straw pulp is composed principally of bast fibers.

Dr. Ritter, in continuing his remarks, said that fibers from different sources differ from one another, not only in size, but also with respect to shape and other characteristics; that as a result of these differences, the fibers in papers and pulps containing fibers from two or more of most of the raw materials can be identified microscopically; and that cellulose fibers of various shapes and markings are present in a single papermaking raw material—some gradually tapering to pointed ends, some with rounded ends, other exceedingly blunt; some thick-walled with slender cavities, and others thin-walled with large cavities.

Springwood fibers, those with thin walls, which develop during the early growing season, stated Dr. Ritter, tend to impart flexibility to the paper sheet while those from summerwood produce stiffness. Reference was made to Nilsson's work which shows that pulp fibers from springwood are more easily ruptured and frayed in the beater than are those from the summerwood; and emphasis placed upon promiscuously spaced cross markings in the cell wall of wood fibers which result from slip planes between the cellulosic microstructural units. These markings, stated Dr. Ritter, produce a weakened condition in the wall structure and that such weakened places in the wall are more readily attacked and dissolved by cellulose solvents than the intermediate portions.

Cotton and Manila hemp fibers, likewise, were said to be characterized by microscopically visible slip planes arranged more or less at right angles to the long fiber axis; while, on the contrary, flax and hemp fibers contain knot-like markings in which the slender microstructural cellulose units appear to bend in the form of a tiny whorl called a knot. Dr. Ritter further mentioned that it is common knowledge that fibers from cotton, flax, and hemp are too long for formation of uniform sheets on a paper machine and require processing to shorten them; but fibers in cornstalks, straws, and wood pulps, on the other hand, are of suitable size for sheet formation—these fibers being processed principally for improving strength properties.

Upon completing his remarks on the size and shape of fibers, Dr. Ritter proceeded to discuss the microstructure of fibers. Reference was made to the views of Bailey and Kerr on the reported substructures of the cell wall; and then Dr. Ritter stated that contrary to the views of Bailey and Kerr, cellular microstructural units have been isolated and photographed. In various published reports, these units, said Dr. Ritter, have been classified under the following headings: cell-wall layers or sleeves, fibrils, fusiforms, spherical units, ellipsoids, and dermatosomes.

It then was pointed out that rarely in woods of the United States are cell-wall layers distinguishable before the fiber has been subjected to rather drastic alternate treatment with acids and alkalies; that, as a result of such manipulation, a number of concentric layers or sleeves comparable in arrangement to those in onions may become

visible in cross-sections of the fiber; that on a longitudinal surface of the fibers the layers appear as lines paralleling the outer and the inner longitudinal boundaries of the cell walls; and that, in reality, those sleeves are thin-walled capsular bodies concentrically arranged. The number of sleeves, continued Dr. Ritter, apparently varies from fiber to fiber and with the thickness of the walls. He said that he had noted as many as twelve in some fibers, and that even more had been reported by Scarth.

Although the different cell-wall layers of normal wood fibers, remarked Dr. Ritter, appear as homogeneous sleeves, they nevertheless are composed of compactly wound cellulosic filaments, named fibrils. A smooth sleeve was said to result from a filling of any interstices between the fibrils with hemicellulosic material which in normal fibers must be removed before the fibril windings become discernible. Difficulties encountered in isolating entirely intact fibrils, said Dr. Ritter, are due to the fragility of the filaments rather than to intersections with cross walls.

Dr. Ritter, in continuing his remarks about fibrils, pointed out that fibrils are loosened from fibers during the beating of chemically prepared pulp, but before they separate, other effects which improve the strength of the paper made from the beaten pulp are produced. These effects were said to generally begin development in the following order —increase in the pliability of the fibers, transverse cutting of the fibers, gelatinization of fiber surface, rupturing of outer layer, fibrillation, and increase in translucency, although the order may differ depending upon the method of operating the beater. In concluding his remarks about fibrils, Dr. Ritter stated that the loose ends of fibrils play a role in the felting properties of paper sheets; and that, if fibers are properly treated, long fibril segments are isolated.

He then proceeded to discuss the subject of fusiforms, spherical units, ellipsoids, and dermatosomes. Under closely controlled conditions, said Dr. Ritter, fibrils have been dissected into slender spindle-shaped structures which have been named fusiforms. Continuing his discussion, Dr. Ritter mentioned that fusiforms from wood are composed of tiny units which assume a spherical shape when they separate from one another; that the spherical units range from 0.2 to 0.4 microns in diameter as isolated in an extremely swollen condition; that Farr has succeeded in isolating ellipsoidal units from cotton fibers; that these ellipsoids are 1.0 by 1.5 microns in size—three and one-half to seven times the size of the spherical units; that these ellipsoids are doubly refractive to light, in which respect they are comparable to the fusiforms; and that Wiesner, by means of heated hydrochloric acid solution, has broken down cellulose fibers into dustlike particles which he believes are microstructural units and which he has named dermatosomes. Dr. Ritter made it clear on the last point that he has not convinced himself that dermatosomes are actual structural units.

Before proceeding with a discussion on the submicrostructure of fibers, Dr. Ritter briefly touched upon supermicelles—a microstructural unit claimed to have been discovered by Seifriz and Thiesen by means of the Spierer lens and ash residue. The microscopically visible units that have been described, said Dr. Ritter, leave an inorganic residue or ash upon burning which, even though it constitutes only a fraction of one per cent of the fiber, still forms a continuous structure that represents a skeleton of the fiber.

In elucidating upon the submicrostructure of fibers, Dr. Ritter first touched upon the structural units known as micelles or crystallites which are supposedly held together by tertiary valence forces and which individually approximate 50 by 50 by 500 to 1000 Å units in size. Then he suggested that primary valence chains—long, slender structures from 500 to 1000 Å in length —are substructures of the micelles, and that the primary valence chains are held together by secondary valences to form the rectangular bundles, micessels or crystallites. The unit cell, then mentioned by Dr. Ritter, was stated to be a regularly occurring unit diagram in the crystal lattice—a theoretical re-occurring spacing which includes both whole and fractional parts of physical structures and with dimensions, calculated from X-ray diffraction data, of 7.8 by 8.3 by 10.3 Å.

The remainder of Dr. Ritter's paper was given over to a discussion of the physical properties of cellulose fibers under such topic headings as shrinking and swelling, compression fibers, resistance to fibrillation, and types of dissection. In this portion of the paper it was pointed out that wood blocks are prone to increase slightly and isolated fibers to decrease slightly lengthwise when water is absorbed; that internal swelling of partially delignified fibers is considerable and varies from fiber to fiber; that when dry fibers absorb water, both internal and external swelling occur, restoring the lumen to its original size and thereby relieving the strain set up during drying; and that internal swelling of an exaggerated type occurs when swelling agents, such as dilute sodium hydroxide and potassium hydroxide solutions, are employed.

Following his remarks on the shrinking and swelling of fibers, Dr. Ritter briefly reviewed the subject of compression fibers, suggesting that a common irregularity affecting the physical appearance of fibers and known as compression consists of a more or less loose winding of the fibrils—the fibril slope, in general, ranging from 30 degrees to 40 degrees to the fiber axis. Then the resistance of fibers to fibrillation received his attention. In this connection, he stated that fibers from a pulp prepared by a drastic pulping process dissect more easily than those from a pulp prepared by a mild process; that fibers from a pulp that has received drastic mechanical treatment d i s s e c t more readily than those in a pulp having received little mechanical processing; and that alpha pulp, which has been dried, allows the modified cellulose materials to cement the fibrils together by a substance more resistant than that in the original fibers. It was explained also that fibers dissect differently, depending on the severity of their previous chemical treatments; that lignin retards solution of the outer layer; and that a pulp fiber from which all of the lignin and much of the hemicelluloses had been removed would seem the more desirable as a source for rayon.

This very extensive and illuminating paper of Dr. Ritter's was illustrated by numerous lantern slides as were a number of the other papers presented later in the program.

Dr. Landt in commenting upon the paper by Dr. Ritter said that its presentation revealed the complexity and uncertainty of materials formed by natural processes; and that it was difficult to bring up a subject in the field of paper chemistry that did not suggest the question, "What is hydration?"

In the discussion following the brief remarks of Dr. Landt, the question was asked of Dr. Ritter of his opinion regarding the transverse weakness of fibers by drastic treatment. He answered the question by stating that he thought that the slip planes in the cell wall permitted easy cutting of fibers by chemical means. Another question brought out the rate of fiber swelling in water and it was stated to be very rapid—maximum volume being obtained in only a few minutes. It also was brought out in the discussion that it was believed that alpha fiber will occupy less space than chlorinated fiber.

The second paper to be presented during the Thursday morning program was a paper by Dr. Ben W. Rowland, Research Associate and Professor of Colloid Chemistry at the Institute of Paper Chemistry, Appleton, Wis. Dr. Rowland's paper was entitled *Colloidal Aspects of Cellulose* and covered a survey of recent work on selected topics concerning the colloidal behavior of cellulose as related to technical problems of papermaking.

It is helpful, said Dr. Rowland, to regard cellulose as belonging to a group of biochemical materials, the physical, and to a certain extent, the chemical characteristics of which are not fixed, but subject to the natural changes of alteration, degradation and ultimate decay. It was emphasized by Dr. Rowland that among the most important of the natural aging changes in cellulose is that of gradual desiccation; that the moisture content of the fiber affects the physical properties of the fiber itself; that a cellulose fiber holds its moisture in two forms—a colloidal form intimately associated with the hexose elements and a hygroscopic form associated more particularly with capillarity; that the colloidal water exerts a profound influence upon the physical properties of the fiber—its strength, rigidity, swelling and probably those of the finished sheet; and that the capillary water plays a lesser part in strength features but is of great importance in the papermaking operation.

It is common experience, stated Dr.

Rowland, that pulp which has been dried at excessive temperatures or to great dryness loses some of its most valuable papermaking qualities, the desiccation effects being only partially reversible beyond a certain point.

Continuing his remarks, Dr. Rowland said that it is within reasonable possibility that chemical rather than mechanical hydration may be accomplished eventually; that much fundamental work remains to be done on the effects of extraneous matter on the hydration phenomenon; that hydration, as understood by papermakers, may not be identified with colloidal hydration; that attention directed toward thermal changes associated with hydration further help to elucidate the basic mechanism; that heats of swelling of cellulose, as well as velocity of swelling, are most fundamentally a property of minute colloidal structure; and that cellulose as a gel responds in a general way to the ionic effects of the Hofmeister series.

The general mechanism of swelling, said Dr. Rowland, has been explained throughout the colloid literature in terms of the Donnan Equilibrium of unequal distribution of ions across a membrane of selective permeability. Perhaps, he continued, a simpler and more convenient theory of the swelling mechanism, such as the Tolman principle, will be preferred as a working hypothesis, referring the swelling to a general structural dilation as a consequence of an electric double layer lining at the many internal interfaces throughout a fiber, exerting a mutual repellant action and a distending effect, drawing water in.

Then it was pointed out that accessory materials used in paper, such as starch, filler, rosin, and color, are retained in the sheet either through the processes of surface adsorption involving surface energy and electrostatics or (less desirably) through mechanical filtration; that the delicate electrostatic balance between the various ingredients of a papermaking furnish may shift disastrously with comparatively slight changes in pH, temperature, etc.; that the response of cellulose to its ionic environment involves selective adsorption; that a cellulose fiber is endowed with the capacity of liberating free rosin from size and that pulps like alpha and rag which are usually hard to size possess this capacity to a far less degree than the more impure forms of cellulose fibers.

Dr. Rowland also stated that it is of considerable importance to note that the equilibrium of ionic distribution between the fiber and its environment does not establish itself spontaneously; that hydration maxima, as a consequence of ionic distribution, are delayed over long intervals; that the action, when pulp is selectively and hydrolytically removing alkali from rosin soap, is in many cases no more than half completed within a period of one hour; that, according to such data, rosin size put into a neutral beater should behave more effectively if allowed to remain in contact with the furnish for a long period before the alum is added; and that the addition of alum not only brings to completion all chemical reactions involving the size, but because of the adsorption characteristics of the pulp fibers for aluminum ions and hydrous alumina, effects the desirable conditions of receptivity of the furnish for size.

The latter portion of Dr. Rowland's paper was given over to a discussion of the optical properties of cellulose fibers. As in the earlier part of his paper, Dr. Rowland cited the work of a number of investigators. In fact, the bibliographical listings included 34 different literature citations.

In Dr. Rowland's remarks covering optical properties, it was mentioned that cellulose fibers, being of a pseudo-crystalling character, possess the property of double refraction which renders the possibility of producing a completely transparent sheet more difficult; that examination of a micro-section of a sheet of paper under a polarizing microscope affords an experimental procedure to studying the distribution of non-cellulosic materials within and upon the surface of the sheet; and that the fiber may deviate still further optically from the usual is exemplified in the phenomenon of dichroism when cellulose has adsorbed a film of dye or when iodine adsorbed by cellulose is oriented as minute rhombic crystals giving rise to a structure acting to completely plane polarize transmitted light.

In concluding his remarks, Dr. Rowland mentioned the suggestion of Preston that surface orientation studied by the experimental methods of absorption spectra should lead to an evaluation of surface changes through the papermaking process; suggested that the phenomena also offers possibility of making a completely opaque sheet without the use of filler; and ventured the statement that such visions of the apparently incredible, often seen by the research worker, are now and then, with equal incredibility, realized.

Time did not permit any open discussion of Dr. Rowland's paper.

Dr. Landt commented that the paper had stimulated much thought among those present, expressed regrets at not being able to discuss it in open meeting, and then called upon W. B. Van Arsdel of the Brown Co., Berlin, N. H., to present a paper of Dr. Geo. A. Richter, Research Director of the Brown Co., on *Pulping Treatment and Fiber Properties* in the absence of Dr. Richter from the meeting.

In this paper, Dr. Richter told of the development of new papermaking fibers during the past decade; suggested that a groundwood, a sulphite pulp, a soda pulp, and a kraft fiber were the four types of wood fiber at the disposal of the papermaker as little as ten years ago; mentioned briefly the uses to which these fibers were put in the production of paper; and then commented that the papermaker in producing paper of different types and character, is dependent obviously upon the variety of base materials available and upon known technique in conversion of such fibers into finished paper.

Often the papermaker, stated Dr. Richter, is faced with specifications that tax his ingenuity to the extreme—he

Picture of T.A.P.P.I. members and friends on the Board Walk, Atlantic

may be called upon to produce a highly absorbent yet strong sheet or the purchaser may demand a fiber that possesses a high folding endurance, exceptional tear, and a clear watermark.

With these more or less introductory remarks, Dr. Richter proceeded to indicate the wider papermaking scope made possible by the development of new fibers through defining in terms of behaviour and value to the papermaker both the earlier established pulps and the newer fibers.

It was stated that bleached sulphite pulp is characterized by whiteness, reasonable cleanliness, and modern physical strength when converted into paper; that it can be hydrated in from one to three hours and causes no trouble on the paper machine; that it has an alpha cellulose content of about 88 per cent and a pentosan value of from 3 to 5; and that it is definitely less permanent or stable than are the better rag stocks. It was also pointed out that present-day sulphite pulp possesses a better and a more stable color than was the case ten years ago; that bursting strength, tear, and fold of present-day sulphite is from 10 and 20 per cent higher than a decade ago.

Other characteristics of sulphite pulp were touched upon briefly and then soda pulp received consideration. Dr. Richter mentioned the deciduous wood origin of soda pulps; stated that such pulps have low fiber lengths; and that the fiber is very free and resists hydration. Present-day soda pulp, he said, contains about 80 to 84 per cent alpha cellulose and 8 to 12 per cent in pentosan values. It was also explained that soda pulp does not resist hydration because of the high pentosan groups present, but that such freeness must be attributed to changes in the physical form that have been brought about by severe action of the alkali during the cooking. He likewise suggested that the physical character of soda pulp makes it in a sense a specialty fiber—a fiber to be manufactured in considerably lesser amounts than is sulphite and at a production that will probably increase at a much lesser rate.

Kraft pulp next came up for comment. Its low cost of manufacture was cited as was its coniferous origin. Such pulp was stated to be high in lignin residues and to contain from 7 to 10 per cent pentosans. The fiber was said to be relatively free but will hydrate to a hard, firm, exceptionally strong sheet.

Hardwood sulphite, Alpha fiber, bleached kraft, refined semi-bleached kraft fibers, and sodium sulphite pulps, each in the order named, then received the consideration of Dr. Richter.

Hardwood sulphite pulps, said Dr. Richter, are characterized by brilliant color and by a retention of beating properties similar to those found in the better-known softwood sulphites. Surprisingly good strength results were said to have been attained with hardwood sulphite fiber from birch when beaten properly. Hardwood sulphite, it was stated, lacks the pronounced softness of a soda pulp, hydrates readily, and can be used in substantial percentages without subtracting from the firmness that is often sought in a bond or ledger pulp.

Alpha fiber, stated Dr. Richter, was developed to meet the needs for a stock that possesses a combination of characteristics not found in the longer-known wood fibers. This pulp when produced from a coniferous base, it was stated, has the softness of a rag stock; the tear of a kraft fiber; a cleanliness and color that exceed the best bleached sulphites; and, so far as can be determined by accelerated aging in heated air, in sunlight, and in acid atmospheres, the permanence of a rag fiber.

Alpha fiber was said not to be a good base material for conversion into glassine paper, but rather that it lends itself in the production of papers in which opacity is a greater asset than transparency.

High alpha cellulose fiber from deciduous woods was touched upon very briefly—its chief value being stated to lie in its inherent softness and absorbency.

One of the outstanding achievements in the pulp industry in recent years, continued Dr. Richter, has been the appearance of a bleached kraft fiber of outstanding toughness and strength. Some of these bleached kraft fibers, he said, equal the color of a bleached sulphite pulp of ten years ago and the next few years may bring forth bleached krafts that will equal the color of the brightest of present-day sulphite pulps. When used alone, bleached kraft is likely to yield a coarse paper unless special beating procedures are adopted, stated Dr. Richter. If reasonable care, however, is exercised in beating the stock in a substantially 100 per cent bleached kraft furnish, a paper can be produced, he continued, that has the strength, tear resistance, and folding endurance of a sheet that has been processed from new rags.

The group of refined semi-bleached kraft fibers was said to be characterized by physical tests that outrank the highest grade of kraft pulp and a color that resembles pale manila fiber. Papers that contain this fiber, said Dr. Richter, are less harsh in texture than kraft or bleached kraft papers and possess a high degree of leathery toughness. The refined semi-bleached kraft fiber contains about 93 per cent alpha cellulose; and pentosan groups are present to about one-half the extent to which they are found in kraft. This type of fiber, Dr. Richter stated in concluding his remarks upon it, is admirably suited for papers that carry specifications that have heretofore been made exclusively from rope or manila fibers.

Dr. Richter then briefly touched upon sodium sulphite pulps, stating that although the bleached alkaline sulphite pulp have been known and evaluated by the producers of such fibers during the past few years, that the fiber has not been generally available to the papermaker. It was suggested that this pulp, characterized by high physical tests, will undoubtedly be used in larger quantities when adequate economic recovery of cooking chemicals has been more fully worked out.

City, during the Twentieth Annual Fall Meeting of the Association

In concluding his remarks, Dr. Richter said that, on the whole, one is justified in making some generalization pertaining to the paper qualities and test values that may be expected from pulps of various origin and history—that all cellulose products that depend upon their isolation from wood by an acid process are lower in pentosans than are pulps that are produced from the same type of wood with alkaline cooking liquors, and that alkaline cooked wood fibers are relatively high in pentosan and hemi-cellulose groups. He also stated that it was fair to predict that the day is not far off when the papermaker will have at his disposal pulps that will possess papermaking strength, tear, and fold endurance of 50 per cent in excess of values that can now be realized with the best present-day products.

Mr. Van Arsdel illustrated the paper of Dr. Richter with a number of pertinent lantern slides.

Due to the lateness of the hour, the discussion of this paper was omitted and the session adjourned to meet the luncheon schedule.

Luncheon Meeting of Thursday

C. C. Heritage, president of T.A.P.P.I., spoke briefly at the luncheon on the organization of the association. He also brought greetings to the Delaware Valley Section of T.A.P.P.I. from each of the various committees and from the membership at large. He asked for a hand of appreciation for the effort put forth by each of the committee chairmen for the convention. This appreciation was manifested spontaneously following the naming of each of the different individuals beginning with William R. Maull, general chairman, and including Harvey P. Cannon, vice chairman; B. M. Thomas, chairman-Administration and Finance; G. E. Landt, chairman-Program Committee; Edw. J. Albert, chairman-Publicity Committee; Wm. M. Shoemaker, chairman-Entertainment Committee, and Mrs. Harvey P. Cannon, chairman-Ladies' Sub-Committee.

Mr. Heritage likewise introduced A. E. Cadman, of the Canadian Pulp and Paper Association, and W. S. Kidd, of E. B. Eddy Company.

Reference then was made to the historical significance of the locality with the papermaking industry. Mention was made of William Rittenhouse and his early mill, and of William Bradford, the printer. It was stated that Bradford put up the money for the Ritterhouse mill; that Rittenhouse had no competition; and that there was a ten year contract for paper at a fixed price.

Mr. Heritage also referred to the set up in T.A.P.P.I. for the conduct of its business. He mentioned the seven divisions beginning with management and including engineering, raw materials, operating, research and development, converting and consuming, and testing. He called attention to the local sections —Pacific, Lake States, Delaware Valley, Kalamazoo Valley, and New England and stated that the charter for the proposed Ohio section had been approved and that formal installation probably would be made next month.

The informal meetings of the council, made up of all of the membership who are carrying the responsibility of association work, was mentioned, Mr. Heritage stating that the council meets on call. Mr. Heritage also mentioned the work of the executive committee and told of a meeting that the committee had had in Philadelphia to settle some matters for the benefit of the association.

With the completion of these remarks by Mr. Heritage and the arrangement made for a council meeting during the afternoon to discuss tentative arrangements for the annual meeting of next February, the luncheon meeting was adjourned.

The remainder of the afternoon was given over to a golf tournament at the Country Club of Atlantic City, and to the presentation in sound motion pictures of "George Washington's Railroad" at the Ambassador.

The evening program included a "Gay Nineties Dinner Party" with all of its glamor in colorful attire and in entertainment.

Friday Morning Meeting

The morning session of September 20 was presided over by H. C. Schwalbe, Technical Director of Dill and Collins, Inc., and included three papers in addition to several formal discussions based on the first two of them.

Dr. Schwalbe called the meeting to order at about 9:45 a. m. and then requested R. H. Doughty of the Fitchburg Paper Company to present the first paper—a paper entitled *The Effect of Mechanical Treatment of Fibers on Sheet Structure.*

Mr. Doughty mentioned three ways in which to approach the problem of making a particular sheet of paper—(1) use whatever raw materials and equipment are available, (2) evaluate the materials through the medium of a standard processing and to standardize the mechanical treatment as closely as possible, and (3) consider the raw materials as structural units from which the paper is fabricated. The third concept, according to Mr. Doughty, is relatively new and in order to develop it, the properties of fibers and sheets must be measured and their relations studied.

In his discussion of materials, Mr. Doughty pointed out that the fibers are the primary material of the sheet and that on this structure is imposed a super-structure of added materials such as sizing, dye, and filler. Formation, arrangement of fiber axes relative to principal axes of sheet, solid fraction value, and air fraction value were mentioned as the elements of sheet structure. The solid fraction value, the proportion of solids by volume in the paper sheet, stated Mr. Doughty, is the most easily measured and mist important component of structure.

Among the working properties of both sheets and fibers that were mentioned are strength under various stresses, resistance to flow or absorption of liquids, vapors and gases, optical properties, and surface character. Processing was separated into fiber processing and sheet processing—the operation of sheet forming being an intermediate step between fiber and sheet processings. Wet pressing, drying and calendering were given as the steps in sheet processing.

Recent developments in screen fractionation, said Mr. Doughty, give rise to the hope that other means of characterizing fibers simply and independently of test sheets can be found. Mechanical treatment, he continued, can do just three things to fibers—increase flexibility, split, and shorten.

The relation of fiber treatment and the wet solid fraction then came up for consideration. Based on tests, it was pointed out that water removal from sheets was less for slow than for free stock at any pressure although the sheets were pressed to apparent equilibrium—a free sheet not only drains but presses easier than a slow one. It also was stated that the variation of water removal under a given condition from fibers given different processings is small, though definite; and that shrinkage of sheets of processed fibers is greater because they are short, slender, and relatively weak.

The behavior of fibers of different dimensions and flexibility during the forming of the sheet was said to be a problem of hydraulics—that fiber arrangement is dependent on what takes place in this stage.

In concluding his remarks, Mr. Doughty suggested that it is logical to demand not only qualitative but quantitative information in order to make paper accurately and economically; that such exact information is now almost wholly lacking; and that there is no reason why it cannot be accumulated gradually.

The program proceeded at this point with the presentation of a paper on *The Principles Governing the Arrangement of Fibres on the Fourdrinier Wire.* This paper was presented by A. M. Lund of the Kennebec Pulp & Paper Company.

Mr. Lund commented that the velocity of stock as it enters the headbox must not be too high; stated that the headbox proper is far from ideal; and suggested that simplification of design may have been carried too far to avoid the possible accumulation of slime. He exhibited several drawings illustrating a design of headbox that was developed from a utilization of the principle involved in the flow of water through a hydraulic turbine. This box was wider considerably than the breast roll and utilized contracting areas in both the vertical and horizontal plane—a feature which Mr. Lund said had a tendency to quiet down the stock.

Adjustments for sheet formation, in the opinion of Mr. Lund, should be made behind the lip rather than through adjusting the lip itself. He said that variations in the lip show up in the sheet. The table rolls also have an influence on the sheet, continued Mr. Lund. These rolls, said he, create pressure and suction under the newly formed sheet and thus produce a pulsating action. Mr. Lund suggested that the sheet went through quite a severe ordeal in going over the rolls; and further stated that if moisture leaves the sheet too early, there

is trouble and that too much water also causes trouble.

The mechanics of sheet forming on a machine with one or two straight slices was touched upon. If only one slice was used, the apron was said to extend down the wire to less than an inch or two of the slice; and that as soon as the stock leaves the apron, a large amount of water passes through the wire—the first phase of sheet forming. The second phase was said to take place on the wire itself after leaving the slice.

The introduction of the second slice, said Mr. Lund, prolongs the pressure head in forming the sheet—the distance between it and the first slice determining the minimum head that can be carried at this point. If the two slices are too far apart, Mr. Lund stated that eddy currents would be set up. Mr. Lund likewise expressed the thought that the principle of the straight slice is superior to that of the high pressure inlet on long fibered stock.

After discussing briefly the object of a high pressure inlet, Mr. Lund offered the suggestion of a suction breast roll. In his opinion such a roll would take care of any of the disadvantages of a single or a double slice and would eliminate water at a point that is most vital for high speed operation. Such a roll, concluded Mr. Lund, offered two outstanding possibilities—that of a shorter wire and that of keeping the same forming conditions at different speeds by controlling the vacuum.

Immediately following Mr. Lund's presentation of his paper, Dr. Schwalbe opened the meeting for formal discussion and called upon J. d'A. Clark of the Scott Paper Company for remarks.

In his remarks, Mr. Clark stated that there was a large variety of opinions relative to the design of headboxes and slices, that uniform flow and complete dispersion of fibers is desirable; and that smooth flow of stock is apt to give sheet a too clotted appearance.

Mr. Clark then proceeded to list a number of factors of sheet formation which he said were fundamental. Among these factors were length of fiber, heterogeneity of fiber length (uniformity not desirable), fineness or thinness of fiber, internal structure of fiber (elasticity of fiber when wet), external surface structure of fiber, consistency of stock, temperature of stock, presence of other materials in stock, quantity of white water and broke added, degree of flocculation (essential to get good dispersion of stock on the wire), orientation of fibers in suspension, velocity of stock on the wire, direction of stream of stock issuing from lip of slice, facilities for draining of water, loss of fines and fillers through wire, drying and consequent shrinkage of sheet, and the compacting effect of calenders and supercalenders.

Mr. Clark in the making of his remarks complimented Mr. Lund for opening up the subject of appiying hydraulic principles to paper machines and also complimented Mr. Doughty for his work.

The second formal discussion on the papers of Mr. Doughty and Mr. Lund was made by H. R. Murdoch, Research Director, Champion Paper & Fibre Co.

Mr. Murdoch developed his discussion from the point of view of kraft paper production. He said that there is a difference in the use of two fibers; and that kraft has been looked upon as inferior. Then he questioned what would be had in the way of fiber if both sulphite and sulphate pulps were made from the same wood.

In the opinion of Mr. Murdoch, it is necessary to go further than the study of hydraulics; more should be known about colloids. He further stated that impurities mean different behavior in composite furnishes; that tannins have a definite influence on fiber characteristics; and that impurities determine the type of papers that are going to be made to a degree greater than has been appreciated.

He expressed the thought that it isn't fair to conclude that alkali as present in kraft and soda pulp does not matter; and concluded his remarks by suggesting that in addition to the hydraulics and mechanical aspects there is the colloidal aspect of various ingredients one with another.

Another discussion followed that of Mr. Murdoch. It was a discussion by Engelbert Krichels, Chief Chemist, Hurlburt Paper Company. Mr. Krichels, in commenting on the subject of sheet formation, said that the problem goes back to the beaters; to the beater bars, and to their effect on the stock. He compared the variations in fiber lengths of cotton and linen with coniferous and deciduous wood fibers and with straw; and suggested that the right raw material be selected from nature to make a given paper. A slice suggestion, likewise, was made by Mr. Krichels.

Shortness of time again made it necessary to dispense with further discussion and Dr. Schwalbe called upon Miss Wanda K. Farr, Associate Cotton Technologist, Cotton Standardization Research, Division of Cotton Marketing, Bureau of Agricultural Economics, United States Department of Agriculture and stationed at the Boyce Thompson Institute for Plant Research, Inc., Yonkers, N. Y., for her paper on *The Formation and Structure of Cellulose Membranes.*

In this paper, which Miss Farr, aided with a number of excellent lantern slides, presented most vividly and interestingly, it was brought out that the combined research of both botanists and chemists during the past century in the field of cellulose analysis has contributed but little of fundamental importance to our knowledge of cellulose. From the botanical viewpoint, however, Miss Farr stated that there are certain general properties of cellulose which are worthy of special consideration. She emphasized the fact that cellulose is a product of living protoplasm and, once formed, is used most extensively in constructing a wall around the protoplast.

Microscopic analysis of cellulose membranes of bacterial origin (from cultures of Acetobacter xylinus) showed that the cellulose is a part of the bacterial organism itself and that it is not being synthesized from the culture medium by enzymes of bacterial origin. The bacterial cellulose, said Miss Farr, is therefore the product of the living protoplasm of the bacterium and the method of its formation from available food materials is still linked inextricably with the life processes of the organism. With a few simple forms of technique it was suggested that much could be accomplished in making a detailed analysis of the more complex types of cellulose membranes found in higher plants.

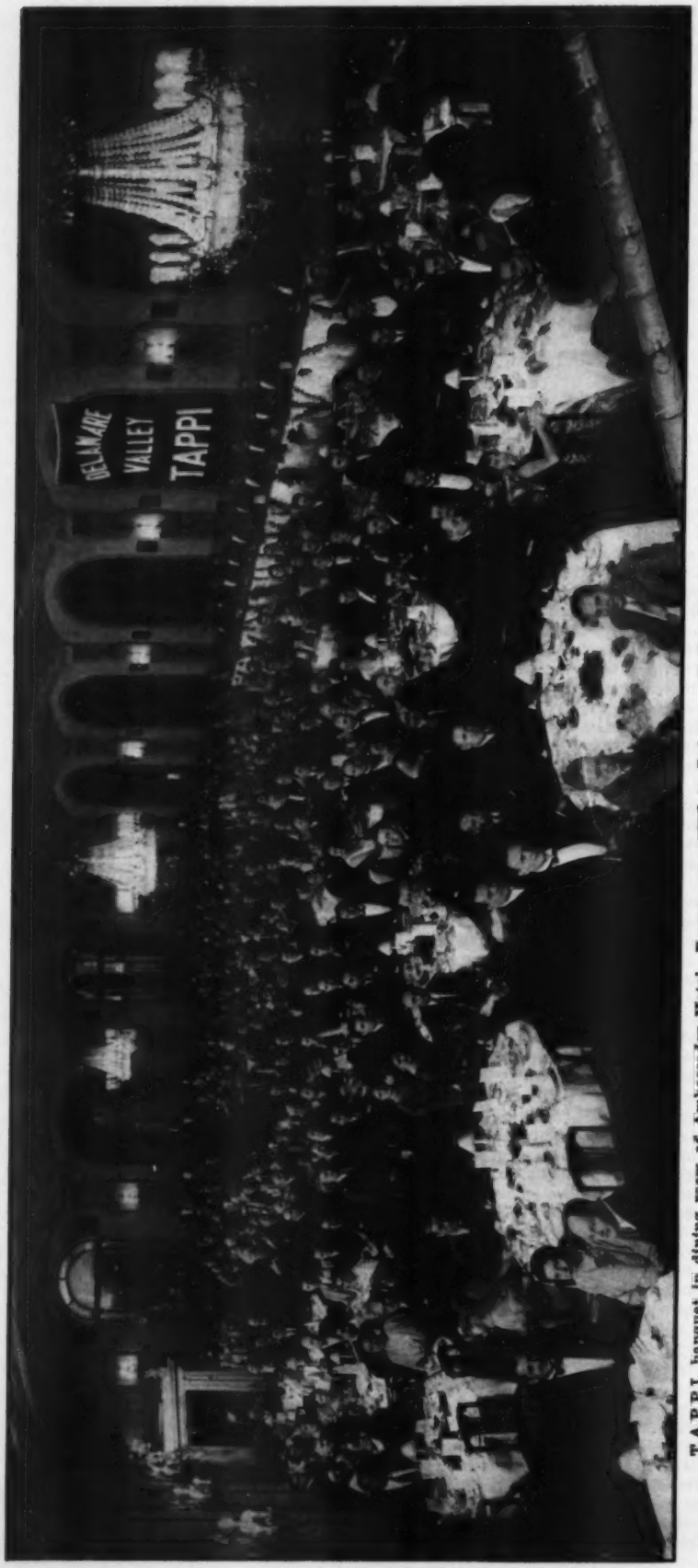
The cell membrane formation in the cotton fiber was explained in some detail. It was stated that in the cytoplasm of the young cotton fiber there are a large number of ellipsoid particles, remarkably uniform in size and separate or in beadlike strands; that separate particles and short chains are found in the central regions of the cell, and longer chains in the outer portions of the protoplast (the particles in some of them being so closely appressed end to end that separate identity is lost); and that the final step in the process consists in the close appression of the fibril to the outer membrane. The importance of the material which coats the surfaces of the particles and serves to bind them together in the process of membrane formation, continued Miss Farr, must not be overlooked.

Some emphasis also was placed on the degradation of the cell membrane in cotton fiber—it being suggested that if the process of cellulose membrane formation takes place as described that the mature membranes should break down into fibrils and fibrils in turn into particles identical with those seen in the living protoplasm. Methods of treatment to bring about this wall degradation were suggested and photomicrographic evidence exhibited to substantiate the concept.

From many x-ray diffraction analyses, Miss Farr said, the cellulose unit cell is known to have approximate dimensions of 8.3 x 10.3 x 7.9 Angstrom units while the dimensions of the microscopically visible cellulose particle are 10,000 x 15,000 Å—the cellulose particles presumably being aggregates of the cellulose unit cells. It likewise was stated that the cellulose particles are not identified with the "micellae" of previous investigators, structures approximately 50 x 500 Å in size which are assumed to be present in the membrane but entirely invisible microscopically.

In concluding her remarks, Miss Farr suggested that future research in these fields presents no more important problem than that of the origin and nature of the cellulose particle itself; that the data presented concerns cellulose membrane formation and not cellulose formation; and that it is more than probable that a careful study of the developing wood cell represents the proper approach to the problem of the chemical and physical relationships of the cellulose, lignin, pectin, etc., in these membranes.

Miss Farr's paper completed the formal session of the morning program of September 20 with the exception of a few remarks by J. P. Hagenauer, Consulting Engineer, American Paper and Pulp Association, on some of the service



T.A.P.P.I. banquet in dining room of Ambassador Hotel. Banner presented to Delaware Valley Section, host at the convention, is displayed in background

work of the association and possible future developments. Mr. Hagenauer asked for the suggestions of technical men in connection with the work.

Opportunity and Pure Research

H. P. Carruth, Vice President, Dill & Collins, Inc., was the speaker at the noon-day luncheon. He was introduced by Grellet Collins and spoke briefly on "Opportunity."

In his remarks, Mr. Carruth stated that the paper industry had been in a transitional stage for a number of years, that technology was given earlier recognition in civil, mechanical, and power house engineering and that later recognition came to the chemist; that paper is to be purchased more and more on specifications; and that management must correlate the industrial factors of finance, operation, merchandising, and research.

No technician, said Mr. Carruth, can foretell in his early years where opportunity may occur. Business success, he continued, may be determined by one's ability to guess the intangible factors. The experience of the successful practical man in evaluating intangibles was cited; and the suggestion made that knowledge can be obtained from people without academic training.

The technician, stated Mr. Carruth, should learn all sides and angles of the business in which he is engaged and should keep in mind that his company is in business to make profits. He suggested that the individual study his own business and hunt for better ways of doing things, for ways of saving without any capital expenditure, and for methods of utilizing by-products of the plant. Mr. Carruth concluded his remarks by saying that if the hunt was successful, one need not worry about promotion.

The awarding of the golf prizes for the tournament of the day before followed immediately after the remarks of Mr. Carruth. J. C. Dieffenderfer made the awards—first prize going to A. J. Campbell, second to E. L. Tewksbury, third to Thomas Stirling and C. E. Mueller (who tied for it), and fourth to F. K. Becker. Other prizes were awarded to A. M. Cooper, K. M. Thorsen, W. N. Greer, and C. L. Bachelder.

The luncheon program was over with the awarding of the golf prizes, and the remainder of the afternoon was left free to enjoy motion pictures of pulpwood operations in various regions of the world that were exhibited by R. J. Egan of Bulkley, Dunton & Co., or in any other way that took one's fancy.

Dr. Compton Addresses Banquet Meeting

G. E. Landt of Continental-Diamond Fibre Co. was toastmaster at the Friday evening banquet. He first called upon H. C. Cannon of Container Corporation of America for some remarks. Mr. Cannon, Chairman of the Delaware Valley Section of T.A.P.P.I., retold briefly the history of papermaking in that territory. He mentioned several of the early mills—the Rittenhouse, De Wees, and Willcox; told of Gilpin's cylinder ma-

chine; stated that the first daily newspaper printed on paper made from straw pulp, was published in Philadelphia; said that the first soda mill in the United States was located within the environs of what is now Philadelphia; referred to the invention of the sulphite process by Benjamin Tilghman; and suggested that the existing paper mill properties within the territory were making every effort to more firmly establish themselves in the industry.

Following the remarks of Mr. Cannon, C. C. Heritage expressed on behalf of the executive committee and members of T.A.P.P.I. the pleasure of being in Atlantic City for the twentieth anniversary of the first fall meeting. He expressed the hope that the meeting might stimulate the beginning of new friendships and emphasized the intangible benefits of membership in the association. Among these benefits that were mentioned were the strengthening of imagination, the strengthening of vision, the building of creative thinking, the improving of self-expression, the enjoying of companionship, and the making of friends. He said that these intangibles can only be earned as it is only by giving that we receive.

Mr. Heritage stated that he was proud of the accomplishments of all of the different sections of T.A.P.P.I. and particularly was he proud of the Delaware Valley Section. He expressed the wish that the Delaware Valley Section continue to prosper and grow and share in the activities of the association. He then presented Mr. Cannon, as Chairman of the Delaware Valley Section, with a large banner which carried the words—DELAWARE VALLEY TAPPI—and which was centered and hung directly behind the speakers' table throughout the duration of the convention. This presentation apparently came as a surprise to Mr. Cannon but he accepted it with no little pride.

The speaker of the evening, following the banner presentation, was introduced by Mr. Landt. The speaker was Dr. Karl T. Compton, President, Massachusetts Institute of Technology who early in his remarks eulogized the papermaking industry by stating that the knowledge of the world comes to us through the medium of paper; that the industry furnished permanent employment to a large number of people; and that the industry had created permanent values to large tracts of timber. He said that he had a healthy respect for the variety of problems faced by the association and expressed words of sympathy because of depression troubles. The danger, stated Dr. Compton, is in applying an overdose of business medicine while the trouble is to know where we are financially speaking.

Dr. Compton, following these remarks, launched into his subject of the evening—*Academic or Pure Research*. He first credited practical industrial research as being one of the most important things in creating our present civilization. Then he suggested that academic research also had played its part and cited several illustrations to indicate the correctness of his statement. One of the illustrations cited was the contribution of Joseph Henry. Joseph Henry, said Dr. Compton, started out to be an actor; became ill; was loaned a book on Natural History; was intrigued by questions in it; devoted his life to the study of the questions; and finally became director of the Smithsonian Institute in Washington. His curiosity and experiments caused him to discover the phenomenom of self-induction—laws of transformers—and to do it, continued Dr. Compton, he used strips of his wife's petticoat to insulate the wire from which to make a magnet; used his students as a means of measuring voltages by having them hold hands and noticing the effect of shock; and built himself a wireless telegraph outfit that permitted his wife at home to reach him at the laboratory. The experiments of Joseph Henry, said Dr. Compton, were not commercialized at the time but they laid the basis of our modern electrical industry.

Dr. Compton also with a few brief remarks touched upon the work of Faraday, and Roentgen, and suggested that the opportunity ahead is greater now than in the times of Henry, Roentgen, and Faraday. He expressed the belief that we are only on the threshold of what science can do; mentioned the rapid development of the alloys industry right through the depression; and pleaded for sympathetic consideration for those working on problems not so immediately practical.

Dr. Landt, previous to adjourning the banquet meeting, thanked Dr. Compton for speaking before the association and told him that T.A.P.P.I. in general was in sympathy with his plea.

Variety of Subject Material

Seven papers were scheduled for presentation, two of them by title only, before the Saturday morning meeting of which James d' A. Clark was Chairman.

The first paper, *The Drying of Pulp and Paper*, was the subject of D. W. McCready, Assistant Professor of Chemical Engineering, University of Michigan. In this paper, divided into two parts, Professor McCready first discussed the effects of the principal variables on the rate of air drying and then took up the mechanism of drying of pulp slabs on heated surfaces. In the first part of his paper, the variables considered are thickness, density and porosity of slab, and the temperature, humidity and velocity of air stream. Explanation of the drying rate curve was given and then it was suggested that the effects of the mentioned variables are shown by the changes they produce in areas under drying rate curves and that as these areas increase the total times required to dry a slab decrease.

Professor McCready in the second part of his paper reported on experimental data that had been obtained on the rate of drying of pulp slabs in contact with hot surfaces under experimental conditions similar to conditions in drum drying processes. It was pointed out that the mechanism by which a slab dries depends upon the distribution of the temperature and aqueous vapor pressure gradients through the slab; and that a slab dries at a constant rate as long as the aqueous vapor pressure difference between the air-slab interface and the stream of drying air remains constant. The factors that have the greatest influence on the rate of drying of paper, said Professor McCready, are the temperature of the hot surface, the thickness of the paper, and the use of a drier felt. The temperature of the drying air was stated to have little effect on the rate of drying as most of the heat required for drying is supplied from the hot surface. It also was emphasized that changing the relative humidity of the air has little effect on the rate of drying providing the difference between the hot surface and drying air temperatures is large.

The second paper scheduled for Saturday morning was the subject of C. M. Baker, Engineer, American Paper and Pulp Association and was entitled, *Tolerances in White Water Losses*. Mr. Baker stated that standards or objectives limiting losses, toward which to work in white water utilization, are desirable; and that adoption of arbitrary standards by state officials limiting stream pollution is not feasible because of variations in grades and operating conditions in the mill, and stream characteristics and requirements, but limiting values might be adopted beyond which a mill should show cause why better operation should not be secured. Present day practice by some of the better operated mills was indicated by diagram and a table of suggestive standards for fiber loss and fresh water required in processing was given—the table being reproduced herewith:

Tolerant Losses

Class	Fresh Water Gal. per Ton Excellent	Tolerant	Per Cent Fiber Loss Excellent	Tolerant
Pulp Mill, Unbleached	20,000	30,000	1.00	1.75
Pulp Mill, Bleached	25,000	40,000	1.25	2.00
Paper Mill (no stock washing)	10,000	20,000	1.00	1.75
Pulp (unbleached) and Paper	25,000	35,000	1.50	2.25
Pulp (bleached) and Paper	30,000	45,000	1.75	2.50
Paperboard	3,000	6,000	.75	1.25
Book Mills, Filler Loss in per cent of Filler Furnish			20.00	30.00

Short runs, continued Mr. Baker, probably constitute the most difficult problem in arriving at any definite conclusions regarding white water losses. Among the other limiting factors that were mentioned are color, furnish, and sheet characteristics—experience indicating that white water utilization

tends to increase opacity, a desirable characteristic in most papers, but objectionable in glassine.

Color Analysis and Specification, the third paper on the program, was the subject of Dr. Joseph Razek, Randal Morgan Laboratory of Physics, University of Pennsylvania.

Dr. Razek discussed the principles of color analysis and stressed the fact that the color of an opaque object, as interpreted by an observer, involves three independent factors: (1) the character of illuminating source will determine color sensation which observer experiences; (2) the color which observer assigns to object is affected by selective reflecting power of object to various component colors; and (3) the responsiveness of visual mechanism of observer to various colors will determine sensation which he will experience. Any fundamentally correct method of color specification, said Dr. Razek, must recognize these three factors.

Dr. Razek then outlined the spectrophotometric method of color analysis and followed it with an explanation of the method of reducing an analysis to trilinear co-ordinates in accordance with the procedure suggested by the International Committee on Illumination in 1931. He further discussed the calculation and significance of dominant wave length, colorimetric purity and relative brightness, giving a sample calculation, and added that in the case of white samples, a further calculation from the trilinear co-ordinates makes possible the calculation of "whiteness' in accordance with Judd's formula.

In concluding his remarks, Dr. Razek stated that much work has been done and effort expended by those who have been engaged in extending the use of the spectrophotometric method of color analysis and specification in industry and expressed the hope that his paper would help to introduce these ideas to those of the pulp and paper industry who can make the best use of them.

The two remaining papers on the schedule for presentation included a paper on *The Effect of Temperature and Consistency in Mechanical Pulping* by E. R. Schafer and J. C. Pew, both of the staff of the U. S. Forest Products Laboratory, and a paper entitled, *Testing Methods for Evaluation of Unbleached Chemical Pulp by D. Johansson*, Chief Research Chemist, The Swedish Pulp Co.

In the first of these two papers it was explained that white spruce and loblolly pine pulpwood were ground in the Forest Products Laboratory two-pocket experimental grinder at various temperatures and consistencies on several types of stone surfaces under carefully controlled conditions. As a result of this investigation it was suggested that the grinding process is favored by high temperatures, provided excessive pulp consistencies are prevented by the use of warm shower water; that high temperatures in nearly all cases caused an increase in grinding rate, a decrease in power consumption an increase in strength of pulp, and a material increase in fiber length and freeness; and that increase in consistency of pulp in grinder pit above 4 per cent caused an increased power consumption with a decrease in grinding rate. It was also stated that at the consistencies employed, the grinding temperature had little effect on the color of the pulp.

In the paper by Mr. Johansson on *Testing Methods for Evaluation of Unbleached Chemical Pulp*, it was brought out that the Swedish pulp mills use exclusively spruce *(Picea excelsa)* for producing sulphite, and mostly pine *(Pinus sylvestris)* for sulphate. The determination of the lignin content of pulps was said to be necessary in order to control the degree of cooking; while, for the practical evaluation of pulps, it is sufficient to determine their consumption of oxidizing agents such as chlorine, bleaching powder or permanganate. It was stated that, in Sweden, the Roe chlorine number is used as the standard method for estimating the degree of cooking. It also was mentioned that the Roe chlorine number may be determined by a permanganate test, the Oestrand method, using a conversion curve. Both of these methods were described in detail.

At the same time, a survey of the chief methods used in Europe for the determination of strength properties of pulp was given and some of the factors affecting the results are mentioned. The methods mentioned included the Swedish, English standard, and German. The chances for introducing an international standard method at present, in the opinion of Mr. Johansson, seems to be poor as all of the methods involve rather complicated and expensive apparatus. Some emphasis also was placed on the relation between chemical and physical properties of pulp, it being suggested that some conclusions about the physical properties of pulps can be drawn from chemical tests if the pulp is produced according to common methods.

The first of the two papers scheduled to be presented by title was a paper by William R. Willets, of the Titanium Pigment Company, on *Factors Affecting Retention*. This paper resulting from a laboratory investigation on the retention of fillers and primarily on the retention of titanium dioxide showed that retention is increased by increasing the amount of alum up to 3 per cent (based on the weight of the fiber) after which retention decreases slightly; that such starches as were investigated exerted a deleterious rather than a beneficial effect on retention; that hydration resulting from beating causes marked increases in retention; that retention increases with increasing basis weight; that an increase in temperature in the sheet machine causes marked increases in retention; that increased dilution in the sheet machine causes increases in retention; and that retention is not primarily dependent on the characteristics of an insoluble filler but is influenced materially by alum, temperature, dilution, hydration, basis weight, etc.

The second paper scheduled to be presented by title was a paper by J. P. Hagenauer, American Paper and Pulp Association, on *Hourly Wage Rates and Their Relation to Minimum Hourly Rates in the Paper and Pulp Industry.* Mr. Hagenauer, in his paper, described briefly several wage rate theories: cost of subsistence theory, specific productivity theory, wage fund theory; residual claimant theory, and the bargaining theory; made deductions from the theories mentioned as well as others about wages; and stated that the wage problem has two distinct elements—what constitutes a day's work and what price shall be paid for such a day's work. Technological unemployment was touched upon, and tables showing wage rates for occupations in the paper industry given. These tables show the ratios existing between occupational rates and minimum rates.

The luncheon on Saturday brought to an end the program of the twentieth fall meeting of T.A.P.P.I. The speakers at this meeting included W. R. Maull, Vice President of Dill and Collins, and C. W. Boyce, Secretary, American Paper and Pulp Association.

Ladies Program

Although this report has been confined largely to the convention proceedings proper, it should not be forgotten that the ladies, too, had their place in the activities. They had their day in Philadelphia, as did the men at Wilmington, and whom they joined by boarding the special train for Atlantic City at North Philadelphia. They also enjoyed jointly with the men each of the several evening programs—the How-dee-do Supper, the Gay Nineties Dinner Party, the banquet, and the final luncheon on Saturday.

Interspersed with these functions were numerous functions exclusive for the ladies. This program included surf bathing, special luncheons, rolling chair ride, ocean sail, and a swimming contest.

Convention Committee Tribute

Surely, real credit is due, not only to those who presented papers and have already been mentioned, but also to those who gave of their time, ability and energy in formulating the program and in seeing to it that the convention activities just "clicked." May the following listing of committee members serve as a tribute to their efforts:

General Chairman—William R. Maull; **Vice Chairman**—Harvey P. Cannon.

Administration and Finance—Chairman, B. M. Thomas; Vice Chairman, H. H. Hanson.

Finance and Accounting (Sub-Committee)—J. C. Harper, R. M. Bates, J. J. Hearn. Railroad and Transportation (Sub-Committee)—Ralph B. Thomas, B. T. Finn.

Program Committee—Chairman, G. E. Landt, James d'A Clark, A. M. Lund, H. C. Schwalbe, C. E. Peterson, Miss R. M. Cobb.

Publicity Committee—Chairman, Edw. J. Albert, L. F. Derr, Jacob Edge, E. A. Holland, V. Jacobsen, R. Morehouse, C. W. Rivise, J. Roslund.

Entertainment Committee—Chairman, Wm. M. Shoemaker, Vice-Chairman, Mrs. Harvey P. Cannon. *Ladies' Sub-Committee*—Chairman, Mrs. Harvey P. Cannon, Mrs. Edw. J. Albert, Mrs. J. d'A. Clark, Mrs. F. E. Winslow, Mrs. J. C.

Harper, Jr., Mrs. W. M. Shoemaker, Mrs. W. R. Maull, Mrs. B. M. Thomas, Mrs. G. E. Landt, Mrs. J. C. Schmidt, Mrs. H. C. Schwalbe. *Trips—Sub-Committee*—Chairman, C. Maurice Connor, N. C. Cooper, S. M. Hesser, G. B. Martin, George Scott, Roy Stearns, Fred Streicher. *Recreation—Sub-Committee*—Chairman, J. C. Dieffenderfer, Emerson M. Glauner, Frank S. McAndrews, Henry W. Piquet. *Registration—Sub-Committee*—Chairman, J. C. Harper, Jr., Miss Annette L. Elliott, R. M. Bates, Miss Lois Hans, Samuel D. Reynolds. *Hotel and Show—Sub-Committee*—Chairman, W. M. Shoemaker, Sylvester M. Hesser, Wm. C. Jay, A. J. Luettgen, C. B. Martin, Lois Taylor.

Equipment Exhibited

Another factor that contributed to the success of the meeting and which is deserving of mention was the exhibition of equipment and apparatus by a number of different firms. Among the exhibitors were:

American Brass Co., Waterbury, Conn. with a display of Anaconda copper sheets, Anaconda phosphor bronze screen plate, samples of wire cloth, copper tubing and fittings, Jordan bar of phosphor bronze, Everdur metal, and example of welding of Everdur metal.

Cameron Machine Co., Brooklyn, N. Y. with an exhibit showing various kinds of paper rolls that are slit on Cameron equipment—rolls ranging from heavy abrasive paper to condenser tissue with a thickness of .00035 of an inch, also Cellophane, Sylphrap, and Protectiod. Rolls were displayed in various widths down to one-quarter of an inch. The exhibit also included photographs of mill type winders, and of an automatic web tension device for use in connection with slitters and web presses.

Chromium Corporation of America, New York City, with a display of chromium plated screen plates (both flat and curved), improved open back screen plate, suction box cover, chromium plated tubing and rolls of different kinds, and a curved chromium plated printing plate.

Continental-Diamond Fibre Co., Newark, Del. with a display of Dilecto, Celoron and Haveg products. Among the products exhibited were Ryertex bearings, suction box cover, roll covers, gears, pipe and fittings, slice board for cylinder machine, molded parts, flexible coupling and pipe union. Suggested Dilecto uses included suction box covers, doctor blades, roll covers, save-all pans, shake panels, slice boards, tank linings, pipe lines, sheets, rods, tubes, drain boards, forming boards, dryer rods, festoon sticks, sealing strips, deflecting panels, and cam blocks. Celoron was suggested for gears, pipe fittings and moulded parts; vulcanized fibre for sheets, rods, tubes, and fabricated parts; and Haveg for tanks, pipe lines, pipe fittings and chemical equipment.

Downingtown Manufacturing Co., Downingtown, Pa., with an exhibit of a completely assembled Downingtown suction felt roll. A list of Downingtown felt roll users also was displayed prominently. The list included applications on both bottom and top felts in board mills, press felts in book and bond mills and press felts in tissue mills.

Edgar Brothers Co., New York City with an exhibit of a solid block of china clay about 18" x 18" x 18" together with photograph showing view of clay mine and a brief story describing the process of preparing clay for use as a filler in paper and cloth.

R. Fuess, Inc., New York City, with a display of Bekk paper testing apparatus including the smoothness tester, smoothness and air permeability apparatus, tensile strength tester, surface scratch tester, hardness tester and fuzz tester together with the Fuess thermo-hygrograph, Fuess sword hygrometer, measuring microscope and photomicrographic camera.

Ingersoll-Rand, New York City, with an exhibit of an operating unit of a Cameron stock pump with portion of casing removed to show pumping action of impeller as well as a Motorpump also arranged to show working parts.

Johns-Manville, New York City, with a display of J-M packing and insulations as well as Transite pipe and Eel-slip suction box cover and doctor blade.

Paper & Industrial Appliances, Inc., New York City, with an exhibit of four different sizes of Poirier weight governors (Sturtevant built), precision consistency regulator (Downingtown built), 8" Fibropump and hydraulic beater with universal impact plate (Warren Steam Company built), sample of shower pipe, and illustrations of Sturtevant bale pulper, pulsating foam killers, Johnston classifying screen for determination of fiber length, settling tank and roller strainer for removing impurities from old paper stock, Thorsen beater, Adka save-all, and installation views of Fibropump and hydraulic beater.

Testing Machines, Inc., New York City, with a display of the Schopper line of paper testing equipment including rapid paper tester, folding endurance tester, freeness or slowness tester, tensile strength tester, micrometer, paper weighing scale, and bending strength tester.

Wilson Mechanical Instrument Co., New York City, with an exhibit of Suvant stiffness testing instruments with a list of their prominent users.

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◆ Carborundum Presents Band Series—Tenth Year on Air

The Carborundum Company, of Niagara Falls, will inaugurate its tenth successive year on the air when its fall and winter program series opens on October 19. The broadcasts, with the same form and personnel employed in each of the nine previous years, will be heard over 18 stations of the Columbia network from 7:30 to 8:00 p. m., EST, every Saturday, originating as usual at Niagara Falls. They will continue through February.

As in the past, the programs will feature favorite band selections, played by the Carborundum Band, under the direction of Edward d'Anna. Francis D. Bowman, Advertising Manager of the company, will again act as narrator, telling Indian legends gleaned from the lore of the Iroquois, and giving a short industrial talk each week to show how abrasives are employed in the manufacture of products commonly used by everyone.

The Carborundum Band has been augmented and the broadcasting facilities have been so improved that company officials anticipate an even broader appeal than before. Responses to the program have increased each year, until last season the total came to more than a half million. Because of this evidence of a large audience, no further changes are contemplated. Retaining the same form and personnel since its first broadcast, in 1926, over a single Buffalo station, the program has created a record unique in radio.

◆ N. I. A. A. Sends Message to Alexander Thomson

A tribute was given to the paper industry when the following message was wired by Gregory H. Starbuck, President of the National Industrial Advertisers Association, to Alexander Thomson, president of The Champion Paper and Fibre Co., Hamilton, Ohio:

"Your personality and presence and sound industrial philosophy are greatly missed at this thirteenth annual conference of the National Industrial Advertisers Association. Every member of us vividly recalls your momentous message given at the Cincinnati Conference of 1934. You were an inspiration and a stimulus to us, that have urged us towards accomplishments that will never cease as long as this association exists. You will be with us very sensitively in spirit and we with you. May your enthusiasm for us and our gratification to you never end so long as we stand for the principles that move us inexorably towards a common objective—industrial peace, security and progress. We look up to you as one of the greatest industrial leaders of our era and we ask your blessing on our sincere and conscientious endeavors."

◆ THE CARBONDALE MACHINE CORP., Harrison, N. J. was recently organized as a subsidiary of Worthington Pump and Machinery Corporation to cover the manufacture and sale of all classes of refrigeration, ice manufacture and air conditioning equipment.

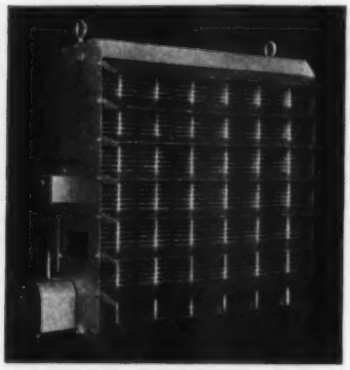
◆ J. F. Glenn in New York Office of Foster-Wheeler

John F. Glenn, who is widely known in the power plant boiler manufacturing industry, has been appointed to the New York office sales division of Foster-Wheeler Corporation.

Mr. Glenn has been associated with the Foster-Wheeler sales activities for the past two years and has previously been connected with other boiler builders. For eleven years Mr. Glenn was in charge of various sales offices for the Wickes Boiler Company and for fifteen years subsequently was New York and New England sales manager for the Edge Moor Iron Company.

◆ Electric Unit Heaters

The Electric Air Heater Company, Division of American Foundry Equipment Company, Mishawaka, Ind., is marketing a line of electric unit heaters. These

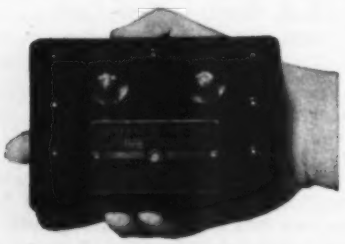


heaters, known as Electromode, are sold in three standard types—one of which is an industrial type unit designed for suspension from ceilings, wall brackets, etc., and for semi-portability around industrial plants.

The outstanding feature of the Electromode heater is a cast-in electric heating unit. This unit consists of a helicoil sheath wire type of resistance heater element cast integral with an aluminum fin type of grid. The heat transformed from electrical energy is conducted through the fin area of the heating unit and is carried off by forced air circulation. This unit, according to statements of the manufacturer, operates with a maximum temperature of 250 deg. Fahr. and has no dangerous hot wires or glow units.

◆ New Phase-Rotation Indicator

A new type of phase-rotation indicator, in which the outstanding innovation is the complete lack of moving parts, has been announced by the General Electric Company. Weighing only twelve ounces and having over-all dimensions of 5½ by 3½ by 3 inches, it can be carried around easily. This instrument will be found very useful in three-phase testing and installation work, such as the testing and installation of three-phase meters and motors.



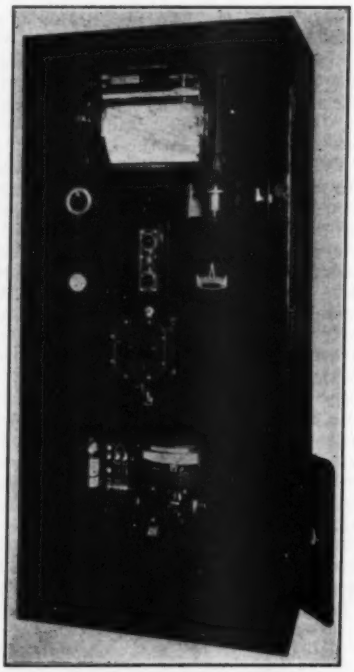
The new phase-rotation indicator employs two neon glow lamps and a simple circuit which requires no adjustment. Suitable terminals are provided for connection to 110-, 220-, or 440-volt circuits.

Pressing a centrally located button lights both of the glow lamps. The button is then released—and phase-rotation, clockwise or counterclockwise, is shown by which one of the lamps remains lighted.

◆ Moisture Control for Paper Machines

The automatic control of the moisture content of paper as it dries on the paper machine has been one of the most difficult problems of the paper industry. The reason for this is that a great number of factors determine the moisture content of the paper and that with present day high speed machines, control has to be extremely fast in operation.

The American Askania Corporation, 1603 South Michigan Avenue, Chicago, Ill., is manufacturing and merchandising a control system which has been developed in close cooperation with paper engineers for this purpose. This control is said to be extremely simple and in-

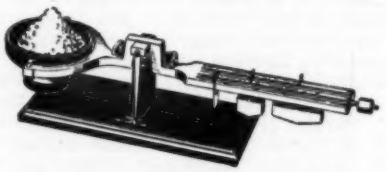


stantaneous in response and in most installations has maintained the moisture content of paper within two-tenths of one per cent. The controlling mechanism, mounted on a panel board, can be set easily by the machine tender for different grades of paper. This mechanism gives a continuous record of the performance of the control, and indicates interruptions of the drying process due to paper breaks or other time losses.

More detailed information about the system will be furnished by the manufacturers upon request.

◆ Portable Balance

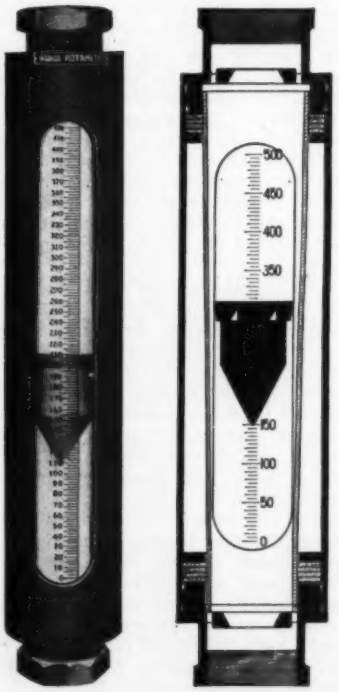
A low-priced balance that weighs up to 100 grams and has a sensitivity of 1/100th of a gram has been announced by The Chemical Publishing Co. of N. Y. Inc., 175 Fifth Ave., New York, N. Y. This balance, known as the Bennett balance, is about 12 inches long; is less than a pound in weight; and has no loose weights to be lost. It has an alloy



steel knife edge and a highly polished agate bearing which make for sensitivity and durability; while a special beam arrest prevents excessive wear of the knife edge and centers the latter automatically for each weighing.

◆ Tubular Case Low Pressure Meter

The Schutte & Koerting Company, Philadelphia, Pa., have placed on the market a tubular case Rotameter for measuring low-pressure liquids and gases. In this design of instrument, a tapered glass metering tube is set into two short fittings which are mounted in a support case consisting of a steel tube threaded at each end and slotted in front for observation of the tube and rotor. The stuffing box seat is a steel ring force-fitted or welded into the steel case. The end fittings confine the packing rings.

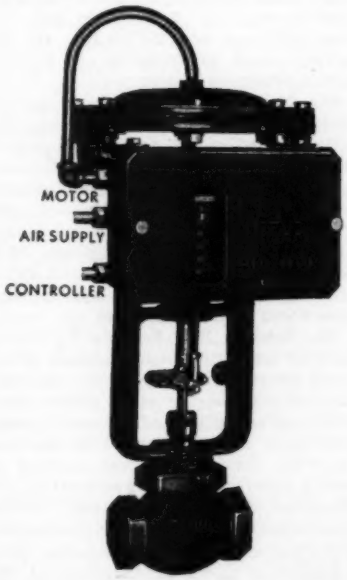


This type of Rotameter is built in sizes from 1" to 4" and is suggested by the manufacturer for applications in low pressure service where the packing will not be attacked by the fluid being metered.

◆ Precision Valve Action Unit for Diaphragm Valves

The Taylor Instrument Companies, Rochester, N. Y., have announced the Taylor "Valv-Precisor" for diaphragm valve applications where load changes are not a problem but where valve stem friction and diaphragm-motor hysteresis must be overcome to obtain precision control. The instrument mechanism is protected by a non-corrosive case and cover—the case dimensions being 8 in. x 5 in. x 2 in. The instrument can be used in conjunction with any air-operated controller on which a direct rigid connection can be made to the valve stem —a 25 lb. per sq. in. air or gas pressure being recommended for most efficient operation. The only necessary adjustment is to adapt the mechanism to the full travel of the valve stem. An indicator which shows the actual percentage of valve opening is visible through a small glass window.

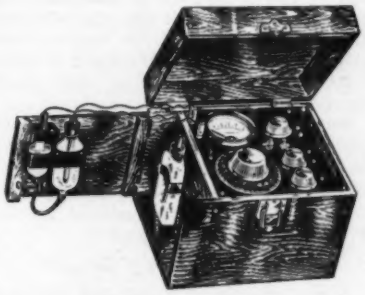
The manufacturer claims that, in general, any air-operated controller with the aid of the "Valv-Precisor" can position the valve disc 50 times more accurately when opposed by valve stem friction and diaphragm-motor hysteresis than when the device is not used.



For complete details regarding the instrument write to the Taylor Instrument Companies, Rochester, N. Y.

◆ Coleman pH Electrometer

A glass electrode pH apparatus, known as the Coleman pH Electrometer, has been announced by the Wilkens-Anderson Company, 111 North Canal Street, Chicago, Illinois. This instrument, stated to be accurate to .05 pH and requiring no outside supports, storage batteries, or accessories, weighs but 15 pounds and is housed in a solid walnut case 12 x 9 x 9 inches. A built-in electron amplifier permits the use of a heavy-wall glass electrode and a meter of rugged design, readings being made from a nine-inch dial scale. Both the glass electrode and the reference electrode, mounted on the swinging door of the instrument case, are filled and hermetically sealed at the factory under a process protected by pending patents.



No preparation of these electrodes previous to the use of the instrument is required except washing in distilled water.

The primary calibration of the instrument is made against an enclosed standard cell with the circuit being independent of tube characteristics or voltage variations.

Complete information about the Electrometer will be furnished by Wilkens-Anderson upon request.

◆ Steel Strapping Unit

A new steel strapping reel and stand with a patented coil control that holds the strapping tight on the reel and releases it as needed has been developed by the Signode Steel Strapping Company, 2600 N. Western Ave., Chicago. The coil control, when the desired length of strap has been drawn out, stops the reel and holds the strap ready for its next application.

This new unit is furnished in three combinations—Nos. 10, 9, and 8. The No. 10 reel includes stand for seals, tools or small shipping units and wheels for portability; while the No. 9 comes without stand and No. 8 has neither stand nor wheels. The last named combination is said to be extremely steady and to serve best when the reel is to be used continuously in one place.

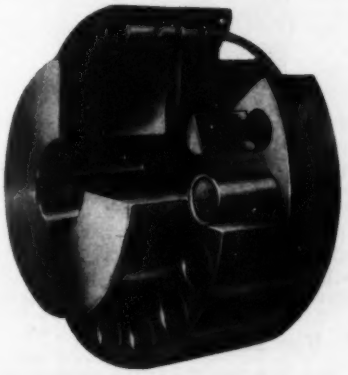
◆ Reflectors for Mercury Vapor Lamps

Specially-designed reflectors for mercury vapor lighting have been announced by The Miller Company of Meriden, Conn. The new Miller equipment includes styles and types of reflectors for any type of mounting, for practically all industrial locations, and for color correction of mercury vapor illumination by individual or combination equipment.

Miller Combination reflectors permit the use of ordinary incandescent lamps with the mercury vapor lamp in a single fixture with mountings as low as 8 feet.

◆ Improved Design of Francke Coupling

The John Waldron Corporation, New Brunswick, N. J., has announced some changes in the design and materials of construction of the Francke flexible coupling. All Francke coupling flanges, except the larger sizes, are being made of a forged high manganese alloy steel. The larger sizes are molded of high grade semi-steel. Self-lubricating, wax-impregnated bronze bushings replace the old style dry bushings. Another improvement is in the design of the cross pins by which the crucible spring steel laminations are held within the keepers. The center portion of the cross pins which passes through the perforation in the laminations is made glass hard. By a special process, the ends of the cross pins are expanded into the tapered recesses of the keepers thereby making it impossible for them to become loose.



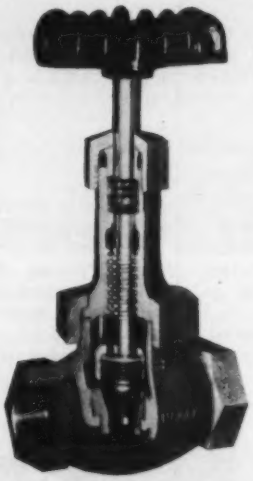
◆ New Stainless Steel Welding Rod

A new stainless steel welding rod for welding chrome-nickel steels of the 18-8 type has been announced by The Linde Air Products Company, 30 East 42nd Street, New York, N. Y. Products fabricated from treated or stabilized 18-8 steel by welding with this rod are stated to have full corrosion resistance and heat resistance in the as-welded condition. No heat treatment after welding is necessary.

The rod, containing a definite quantity of the element columbium, is known as Oxweld No. 28 Columbium—Treated 18-8 Welding Rod (Patent Applied For).

◆ New Globe Valve

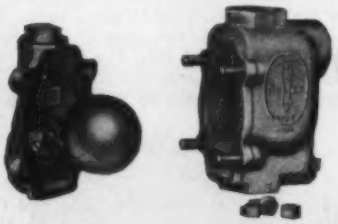
A new union bonnet bronze globe valve has been developed by the Hancock Valve Division of the Consolidated Ashcroft Hancock Co., 85 Elias St., Bridgeport, Conn. Stainless steel valve discs and seat rings, hardened to 500 Brinell, are used in this design of valve and are said to prevent wire drawing, steam cutting and galling. The disc is attached



to the stem in a way to facilitate regrinding and to insure correct seating. Special types of bronze have been developed for the valve stem and bonnet. The design also provides tight backseating and permits repacking while valve is in pressure service. The valve is made for steam pressures up to 300 pounds in both globe and angle patterns.

◆ New Steam Trap

The American District Steam Co., North Tonawanda, N. Y., is placing on the market a new steam trap of a combination float and thermostatic type. The working mechanism of this trap is mounted on the cover. All piping connections are on the body. The cover and working mechanism may be re-



moved for inspection and cleaning without disturbing the piping connections. Another feature cited by the manufacturer for this trap is a stainless alloy steel reversible valve and seat.

◆ Ferrous-Metal Paint

The Harrington Paint Co., Inc., 1630 Collamer Ave., Cleveland, Ohio, has announced the development of a ferrous-metal paint which, it is claimed, makes the removal of rust from the metal prior to painting both unnecessary and undesirable as through its use the rusted surface becomes an essential part of the protective coating. The paint, having a base of chlorinated rubber, is said to be easy to apply and to dry rapidly. Furthermore, the paint is claimed to be equally resistant to acids and alkalies and their fumes and to be improved by salt or fresh water. Sunlight is also stated to have a beneficent effect upon the painted surface.

This paint is suggested by the manufacturer for a priming coat that can be covered with any other type of paint or for use as a finishing coat itself.

◆ Neat Appearing and Comfortable Safety Goggle

A new goggle in which full rocking nose pads have been substituted for the customary nose piece and with earpieces of completely insulated flexible cable has been announced by the American Optical Company, Southbridge, Mass. This goggle, designated as the F3100 Ful-Vue Goggle, is fitted with 6-curve Super Armorplate Lenses. These lenses are stated to be capable of withstanding blows approximately twice as heavy as those which fracture standard lenses. It is also suggested that the surface of the lens is exceptionally effective in deflecting glancing blows and that the

lenses are shaped to fit closely to the eyes without interfering with the eyebrows or lashes.

Complete information on the new goggle may be obtained by writing the manufacturer.

◆ Oil-Proof V-Belt

The Dayton Rubber Manufacturing Company, Dayton, Ohio, has developed an oil-proof V-belt for general industrial use that will be marketed under the name, "Daycoil." The Daycoil V-Belt carries the same laminated construction principles as the regular Dayton Cog-Belts for general transmission applications plus a specially designed casing of a new synthetic compound to resist oil. The oil-proof material used in the construction of the belt, known as "Dayco," has such properties of natural rubber as flexibility, plasticity, and resiliency. It also has aging properties many times that of rubber and much greater abrasive and wearing qualities when subjected to oils and solvents.

◆ Bantam Ball Bearing Allied with Torrington

Due to the very rapid growth of the Bantam Ball Bearing Co. of South Bend, Indiana, during the last six years and because of the large resources and allied business of The Torrington Company of Torrington, Connecticut, arrangements have been made and approved by the Directors of these two companies for an exchange of stock.

The Bantam Ball Bearing Co. will continue operations the same as heretofore in their factory at South Bend, which has been doubled in capacity by recent plant additions, but as a subsidiary of The Torrington Company.

Through this arrangement it is expected that both companies will be better able to more promptly serve their customers and with the combination of resources and facilities supply a still better product.

The latest balance sheet of The Torrington Company, at June 30, 1935, shows a net worth of $11,000,000.00 with current assets of $7,850,000.00 and current liabilities of $681,000.00. Of the current assets $4,830,000.00 are in cash and Government bonds.

The Torrington Company is an old established Connecticut institution originally founded in 1866 and today operates plants in Torrington, Conn., Orange, Mass., Westfield, Mass., Upper Bedford, Quebec, Canada, Coventry, England, and Aachen, Germany, where are made machine needles of all descriptions, bicycles, and bicycle parts, ball and roller bearings, machine screws, swaging machines and metal specialties.

The Bantam Ball Bearing Co. manufactures ball and roller bearings of all types in sizes up to 60" in diameter, supplying these for steel mills, paper mills, rubber mills and all other heavy duty types of machinery, and has been for some time the largest supplier of needle bearings in the automotive, airplane and submarine industries. It was particularly responsible for the success of the rollers used in free-wheeling units.

According to the management of The Torrington Company, it is the intention to maintain the newly acquired plant at South Bend, with no changes in personnel at this time being contemplated and with K. L. Herrmann, general manager of the Bantam Company, continuing to act in that capacity for the new owners.

◆ Seventh Annual International Bates Convention

The Seventh Annual International Convention of the manufacturers of Bates Multi-Wall Paper Bags was held at the Waldorf-Astoria hotel the week of September 17. Fifty delegates representing fifteen countries were present.

Among those attending the convention were leading kraft paper manufacturers from Sweden, Norway, Finland, Germany, France and Mexico who have found in the multi-wall paper bag an important outlet for the increased consumption of kraft paper.

◆ Oxford Making Paper Machine Alterations

The Oxford Paper Co., Rumford, Me., now has in process the modernization of its paper machines with the idea of product improvement and economy of machine operation. According to the present program, eight machines will be completed early in 1936.

At the wet end of the machines, Fourdrinier alterations are being made including improvements to the head box design, Fourdrinier changes, table roll support, deckle devices and slices.

On the dryer sections of the machines, additional dryers and breaker rolls are being added and a general rearrangement is included for the control of the dryer felts and dryer drive which will permit drying paper at lower temperatures with the consequent improvement in quality of product. Dryer steam control systems of the automatic temperature control type and improved condensate equipment is being installed. With these changes, the greatest degree of flexibility will be secured to meet the requirements of the wide variety of papers made in the Oxford mill.

On the dry end of the machine, alterations are being made to the reel drives, the winder drives and the calender air system to improve control.

Other equipment being added includes new cantilever suction couch rolls, cross wire oscillating equipment, complete roller bearings for all table, wire and breast rolls and hypoid drives including magnetic clutches for the couch rolls. Dryer felt equipment of the most modern type is being installed which is intended to allow drying operation to be carried on under the most favorable conditions so far as paper quality is concerned.

◆ Mohawk Paper Mills Corrects Rumor of Closing

Rumors have spread that the Mohawk Paper Mills, Inc., Cohoes, N. Y. would close its mill on October 1. The company wishes it understood that there has been absolutely no basis for this erroneous information.

It is stated, however, that the company's local sales office in Boston has been closed as of October 1, and Boston will be covered direct from the mill by George F. Morrison.

◆ George W. Gilkey

George W. Gilkey, president of the Michigan Paper Company with plants at Kalamazoo and Plainwell, Mich., passed away October 7 in Grand Rapids, Mich., from injuries received in an automobile accident. Mr. Gilkey succeeded his father as head of the company a number of years ago.

Mr. Gilkey was returning from a hunting trip when the accident occurred. Dr. Charles Woodhams, of Plainwell, who was with him at the time of the accident, was injured critically.

◆ New Catalogues and Publications

Paul O. Abbe Inc., Little Falls, N. J.—A new 8-page folder describes in detail this company's line of ball and pebble mills and mixers for both laboratory and production work. The folder is well illustrated and contains a number of dimensional tables. Copies on request.

American Manganese Steel Co., Chicago Heights, Ill.—Two new bulletins recently published by this company are: No. 10 featuring Amsco Nickel Manganese Steel Welding Rod; and No. 20 covering the Amsco Hard-Facing Welding Rods Nos. 459 and 217. These folders contain a considerable amount of descriptive material with illustrations and interesting data.

Brown Instrument Co., Philadelphia—On the occasion of its 75th anniversary this company is offering to the industry a new operated controller, known as Brown Air-o-Line, and has issued a most attractive catalogue featuring these instruments. The simplified construction and ease of adjustment obtainable in this controller is portrayed by text and a number of very fine illustrations. "Tuning in" the throttling range, automatic reset and the interchangeability of control units are fully explained. Copies on request. Those interested should request Catalogue No. 8900.

Combustion Engineering Co., Inc., New York City—A 4-page bulletin titled "Pressure Vessels, Fabricated Plate Work," deals with a variety of pressure vessels and fabricated plate work as furnished by this company for various process industries. Included and illustrated in this bulletin are rotary digesters for pulp and paper mills. Both welded and riveted construction are covered and the shop facilities for producing, annealing and X-raying such equipment are reviewed. Another folder, "Boiler Plant Equipment," describes in condensed form all the types of boilers, complete steam generating units, stokers, pulverized fuel systems and heat recovery equipment furnished by that company.

Esterline-Angus Co., Indianapolis, Ind.—A very interesting booklet recently issued by this company, is entitled Solving Industrial Crimes. The descriptive matter features Esterline-Angus graphic instruments which have numerous paper-mill applications.

General Electric Co., Schenectady, N. Y.—Included in new literature recently issued by this company are the following publications: No. GEA-14270 "The General Purpose Automatic Time Switches," No. GEA-2177 "G-E Power Selsyns," and GEA-246D "High-speed Synchronous Motors 7500 Series."

B. F. Goodrich Co., Akron, O.—A 12-page illustrated bulletin describes the properties of this company's new synthetic rubber-like material "Koroseal." The various forms in which this material is available and the uses for which it has been adapted are included. Copies may be had by writing the Mechanical Rubber Goods Division of the company.

Hancock Valve Division, Bridgeport, Conn.—Two new bulletins have just been released by this company. One describes the new Hancock Flocontrol Valve, which is a combined valve and control instrument. The other gives details on the new Hancock Union Bonnet Bronze Valve, the valve with the superhard stainless steel trim that is claimed to resist steam cutting and wire drawing throughout its long life. Copies on request.

Harnischfeger Corp., Milwaukee, Wis.—A 24-page booklet just published covers the complete line of P&H-Hansen Arc Welders from 50 to 800-ampere units as well as welding fixtures and accessories. Copies on request.

Johns-Manville, New York City—A new catalogue describes most of the industrial products manufactured by this company such as insulation materials, packings, refractories, roofing and siding, flooring, friction materials, electrical materials and transite pipe. The text is amplified with a large number of illustrations, diagrammatic sketches and tables. Another publication just released contains Facts About Built-Up Roofs. In this graphically illustrated brochure, many questions concerning roofs are answered. Drawings show construction details of the most commonly used roofs and are supplemented by a complete table which sets forth the surface, underwriter's rating, materials used in construction and weight per 100 sq. ft. for the many types. Copies of both these publications may be had upon request.

Lawrence Machine and Pump Corp., Lawrence, Mass.—A new bulletin No. 205 covers this company's line of high density paper stock pumps. The bulletin describes fully the construction of this line of pumps which have been designed especially for the pumping of heavy paper stocks, and includes several interesting illustrations and installation views.

Leeds & Northrup Co., Philadelphia, Pa.—This company has just issued a new bulletin on Micromax automatic pH control for "Improved Alum Treatment of Board Stock." The application of this control to the manufacture of board is concisely covered in the bulletin. There is also an elevated drawing of a typical arrangement of Micromax pH control in a board mill. Copies may be had by asking for Bulletin 709-A.

Rag Content Paper Manufacturers, 122 E. 42nd Street, New York City—As a feature of its fall advertising campaign, a new brochure "When to Use Rag Papers," has been published by this association. This brochure is being distributed through fine paper merchants, 300 merchants cooperating in this campaign. The brochure is lithographed in three colors on 100 per cent rag paper and is beautifully illustrated with wash drawings depicting office scenes and industrial backgrounds identified with prominent users of rag papers. Copies of the brochure may be had by writing to the Rag Content Paper Mfrs., at the above address.

Reeves Pulley Co., Columbus, Ind.—A new Speed Control Handbook has just been issued which gives extensive information on modern methods of variable speed regulation for industrial machines of all types. This book outlines the development of methods of speed control. It points out the qualifications that modern speed control equipment should possess and describes and illustrates the variable speed transmission and varispeed motor pulley. There is a great deal of engineering information with dimensional drawings and tables—altogether the book contains 112 pages and is nicely bound with stiff cover.

Stonhard Company, Philadelphia, Pa.—This company, which specializes in the field of industrial maintenance and construction materials, has just issued a guide to successful methods of keeping floors, roofs, walls and foundations in good repair. There are 24 pages profusely illustrated, and so designed that maintenance men, purchasing agents and plant superintendents can gather a wealth of information from it. Copy may be had by requesting by title, "Over the Rough Spots."

Synthane Corp., Oaks, Pa.—A new folder is devoted to Synthane Laminated Bakelite for mechanical application. The essential physical, electrical, chemical and mechanical properties of Synthane are given. Some of the more important material strength values, representative uses, machinability, types of stock, shapes and colors are also included in the contents. One section deals with Synthane Silent Stabilized Gear Material and methods of gear cutting.

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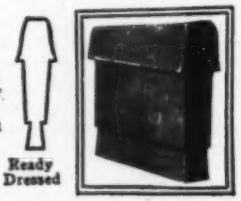

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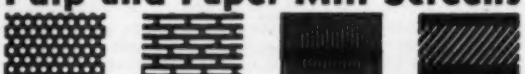

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Papermaking Research Around the World, by Dr. Louis E. Wise.
Identification and Microscopy of Woods and Wood Fibers Used in the Manufacture of Pulp, by Ellwood S. Harrar and J. Elton Lodewick.
Lessons in Paper Making, Part 1, by Harry Williamson.
Lessons in Paper Making, Part 2, by Harry Williamson.
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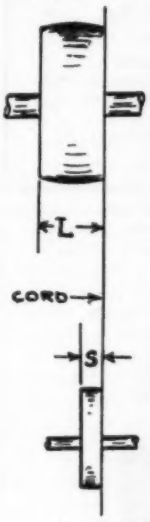
Aligning Paper Mill Pulleys of Different Width

W. F. Schaphorst, M. E.

IT IS easy for the average paper mill mechanic to align pulleys of the same width. An ordinary cord may be used as illustrated to do it. Light, touching contact of the rim edges of both pulleys is all that is necessary.



But where the pulleys are not of the same width a little calculation is necessary. First align the pulleys in precisely the same way as suggested for pulleys of the same width. Then make a mark on the shaft of the narrow pulley to indicate its position and move that pulley in a direction *away* from the cord.

The distance to move the narrow pulley then may be calculated by subtracting the width of the narrow pulley, in inches, from the width of the wider pulley, in inches, and dividing the difference by 2. The quotient will be the distance, in inches, to move the narrow pulley from the mark made on the shaft. The moving of the narrow pulley the calculated distance places the two pulleys in perfect alignment.

For those who prefer formulas to rules, the following formula may be used:

$$D = \frac{L - S}{2}$$

Where

D = distance in inches to move the narrow pulley;

L = width of wider pulley in inches;

S = width of narrow pulley in inches.

Example: If the pulleys are 7 in. and 4 in. wide, respectively, the above rule and formula indicate that the narrow pulley must be moved 1.5 inches — $\frac{(7-4)}{2}$ or 1.5 inches.

◆ Plans Set for Industrial Materials Exhibit

Many new materials and new industrial manufacturing processes will be dramatically displayed at the Third Annual Industrial Materials Exhibit to be held in the Hotel Astor, New York City, on October 21-25. This exhibit is independently sponsored by a group of more than forty manufacturers in a variety of industries.

Features of the show will include new types of plastic materials and their applications—Bakelite Corporation; examples of modern molded plastic pieces—Boonton Molding Company; recently developed water emulsion nitro-cellulose lacquers for paper and paper board—Hercules Powder Company; the manufacture of felt and its countless uses—American Felt Company; the evolution of the screw from prehistoric Eskimo spearpoints to present-day self-tapping screws—Parker-Kalon Corporation; new combination lacquer enamels—Maas & Waldstein Company; stainless steel aeronautical instrument parts and equipment—Ericsson Screw Machine Products Co.; grinding wheels made from genuine South African diamonds—Carborundum Company; and precision steel bearings—Norma-Hoffmann Bearings Corporation.

Other manufacturers which will announce recent developments in the industrial field are the American Hard Rubber Company, American Steel & Wire Company, Brown Company, Peter A. Frasse & Company, Gillespie-Rogers-Pyatt Company, Mt. Vernon Die Casting Corporation, Spaulding Fibre Company, Stackpole Carbon Company, The Texas Company, B. D. Drakenfeld Company, Hazel Atlas Glass Company, Rawlplug Company, and Hillman Brass & Copper Company.

Tickets of admission may be secured from the manufacturers participating in the exhibit.

◆ The Paper Industry Situation in China

According to *Side Runs of the Paper Trade*, official publication of the Bureau of Foreign and Domestic Commerce, paper mills in China utilizing machinery may be divided into two classifications, in each of which are an approximately even number of mills: (a) those manufacturing cardboard

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and wrapping paper, and (b) those manufacturing Chinese writing and printing paper. There are six of the former, distributed among the coastal cities of China. These mills use only native raw materials, and consequently import no pulp. The eight mills producing writing and printing papers are located principally in the city of Shanghai. Only one of these is equipped with what might be considered up-to-date machinery. All of them consume imported pulp, supplemented with rags and waste paper. Imported pulp requirements are estimated in the neighborhood of 9,000 tons annually, consisting entirely of sulphite pulp. The United States, Canada, and the Scandinavian countries are the principal competitors for this trade. Since 1931 the amount of pulp imported has increased steadily, receipts having risen from 84 tons (long ton of 2,240 pounds) during that year to 5,069 tons in 1932, 7,275 tons in 1933, 10,363 tons in 1934 and 8,338 tons during the first six months of 1935. About four-fifths of these imports are consumed by the mills in Shanghai.

At the present time no pulp is manufactured in China by the machine process. In an effort to become less dependent upon the importation of foreign paper and pulp the Ministry of Industries has been studying the feasibility of establishing mills in the vicinity of Wenchow, Chekiang Province. The three sites under consideration have been chosen because of their proximity to the timber supply and their convenient location for transportation. The practicability of this scheme is considered doubtful by those conversant with the pulp and paper market in China. It is pointed out that the manufacture on a large scale of newsprint, which it is intended the projected plant shall produce, requires the use of thousands of tons of long fiber coniferous wood, and it is doubtful if the supply in China is adequate for any length of time. After this supply is exhausted, it will be necessary to import pulp, and the importation of mechanical pulp is considered impractical. (Vice Consul Julius Wadsworth, Shanghai).

◆ Import Committee Issues Special Report Giving Analysis of Anti-Dumping Act

In view of the agitation of a group of American industries for a new Anti-Dumping Act, and the consequent introduction of the so-called Harter Bill, H. R., 8603, the Import Committee of the American Paper Industry has issued a special report giving an analysis of the existing Anti-Dumping Act, the Anti-Dumping laws of other nations, and the Paper Industry's experience under the existing Act. The report shows that in ten years the Import Committee has filed thirty-three complaints of dumping of various papers, and that in only one instance has a dumping ruling been issued by the Treasury Department. The complaints have usually been dismissed on the ground that the American industry did not prove injury by the dumping of the foreign papers. Under the proposed bill, injury is assumed to be automatically suffered if foreign merchandise is sold at prices less than the usual prices in the country of origin.

Glassine from Austria being sold duty paid at about 10½ cents per pound, appears on Customs import statistics as valued at nearly 13 cents per pound, foreign mill value, and duty is being paid on this value. The situation is so evidently questionable that the Import Committee of the American Paper Industry has asked for Governmental investigation on the ground of dumping.

Envelopes of decorated writing paper have been held dutiable at a rate 5 per cent higher than that claimed by the importer.

Red spinning vegetable parchment imported in strips one inch wide will henceforth be classified for duty, not as material, at 2 cents per pound and 10 per cent, the rate for vegetable parchment, but as articles made of such parchment at 5 cents per pound and 20 per cent.

The Treasury Department has reaffirmed its ruling that all pulpboard in sheets must be marked with the country of origin. In administering this provision, Customs officials will consider pulp board to be a board made entirely or of approximately 90 per cent mechanical wood pulp.

Finnish M. G. Kraft Wrapping Paper is found to be sold for export at less than the home market price, and duty is now being levied on a basis of about 10 per cent higher than the actual export sale price.

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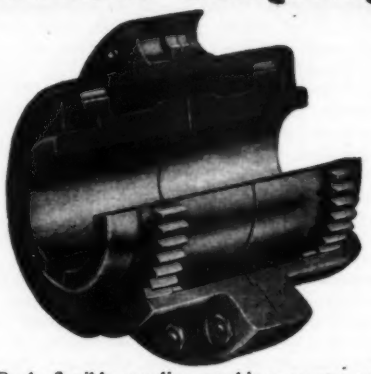

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The Paper Industry Safety Contest

July 1, 1935 to June 30, 1936
Cumulative Scores as of August 31
53 Mills Maintain Record

PERFECT SCORES

Division I—Paper and Pulp Mills

	PARTICIPANT	MILL	LOCATION
GROUP A	Hollingsworth & Whitney Co.	Algonquin & Taconnet	Waterville, Me.
	Ohio Boxboard Co.	Rittman	Ohio
	Bryant Paper Co.	Kalamazoo	Michigan
	Eddy Paper Corp.	Three Rivers	Michigan
GROUP B	Restigouche Company, Ltd.	Campbellton	New Brunswick, Can.
	Kimberly-Clark Corp.	Badger-Globe	Neenah, Wis.
	Nekoosa-Edwards Paper Co.	Nekoosa	Port Edwards, Wis.
	Fraser Paper, Ltd.	Madawaska	Maine
	St. Croix Paper Co.	Woodland	Maine
	Container Corp. of America	Cincinnati	Ohio
	Fibreboard Products, Inc.	Vernon	California
GROUP C	*Container Corp. of America	Manayunk	Philadelphia, Pa.
	Continental Paper & Bag Corp.	Marinette	Wisconsin
	Finch Pruyn & Co., Inc.	Glens Falls	New York
	Continental Paper & Bag Corp.	York Haven	Pennsylvania
	Crystal Tissue Co.	Middletown	Ohio
	Escanaba Paper Co.	Escanaba	Michigan
	Hoberg Paper & Fibre Co.	Fibre Div.	Green Bay, Wis.
	Ontonagon Fibre Co.	Ontonagon	Michigan
	Consolidated Water Power & Paper Co.	Appleton	Wisconsin Rapids, Wis.
	Harriman Co.	Harriman	Tennessee
	Consolidated Water Power & Paper Co.	Biron	Wisconsin Rapids, Wis.
	Kimberly-Clark Corp.	Lakeview	Neenah, Wis.
GROUP D	Union Bag & Paper Corp.	Fenimore	Hudson Falls, N. Y.
	International Paper Co.	Webster	Orono, Me.
	*International Paper Co.	Little Island	No. Tonawanda, N. Y.
	Bird & Son, Inc.	Phillipsdale	Rhode Island
	Hollingsworth & Whitney Co.	Arrostook & Cobbosseo	Gardiner, Me.
	Union Bag & Paper Corp.	Kaukauna	Wisconsin
	Port Huron Sulphite & Paper Co.	Paper	Port Huron, Mich.
	Central Fibre Prods. Co.	Tama	Iowa
	U. S. Gypsum Co.	No. Kansas City	Missouri
	Central Fibre Prods. Co.	Vincennes	Indiana
	International Paper Co.	Livermore	Chisholm, Me.
	Spaulding Fibre Co., Inc.	New Mill	Milton, N. H.
	U. S. Gypsum Co.	Gypsum	Ohio
	Hollingsworth & Whitney Co.	Abenaquis	Madison, Me.
	Central Fibre Prods. Co.	Mt. Carmel	Illinois
	Spaulding Fibre Co., Inc.	Hayes	No. Rochester, N. H.
	International Paper Co.	Riley	Maine
	Mead Paperboard Co.	Rockport	Indiana

Division II—Remanufacturing

	Union Bag & Paper Corp.	Specialty	Hudson Falls, N. Y.
	Union Bag & Paper Corp.	Grocers	Hudson Falls, N. Y.
	New Orleans Corrug. Box Co., Inc.	Bogalusa	Louisiana
	Barber Asphalt Co.	Venice	Madison, Ill.
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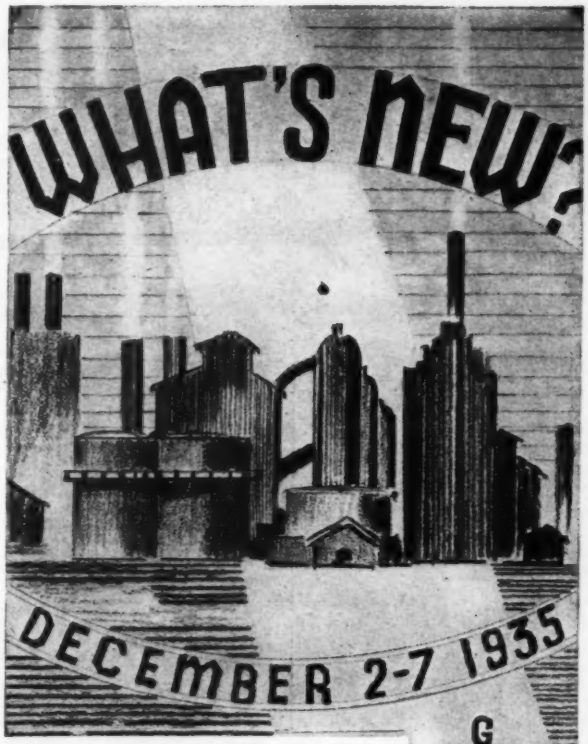
	Key Number	Rank	Disabling Injuries	Frequency Rate
GROUP A	P- 27	5	2	3.196
	P- 19	6	1	3.799
	P- 2	7	2	7.387
	P- 12	8	2	8.534
	P- 31	9	2	9.292
	P- 64	10	2	9.859
	P- 18	11	4	11.382
	P- 1	12	5	11.642
	P- 62	13	4	12.184
	P- 67	14	5	12.628
	P-102	15	5	13.719
	P- 69	16	4	14.826
	P- 10	17	4	15.272
	P- 95	18	4	16.516
	P- 13	19	6	20.297
	P- 74	20	7	22.981
	P- 87	21	7	26.421
	P- 73	22	11	33.877
GROUP B	P- 23	8	1	5.341
	P- 11	9	1	6.364
	P- 68	10	1	6.435
	P- 45	11	1	6.652
	P- 51	12	1	7.348
	P-112	13	1	7.499
	P- 21	14	2	10.394
	P- 3	15	3	18.335
	P- 40	16	4	20.053
	P- 60	17	3	20.070
	P- 16	18	3	20.330
	P- 25	19	5	27.050
	P- 32	20	6	31.808
	P- 76	21	6	38.002
	P- 77	22	6	45.572
	P- 71	23	13	69.535
GROUP C	P- 59	13	1	9.586
	P- 37	14	1	10.156
	P-103	15	1	16.063
	P- 7	16	1	16.073
	P- 4	17	2	17.266
	P- 75	18	2	22.795
	P-111	19	2	24.818
	P- 6	20	2	28.120.
	P- 47	21	2	32.447
	P- 29	22	3	33.894
	P-104	23	5	42.352
	P- 88	24	4	42.592
	P- 14	25	3	43.350
	P-107	26	3	45.799
	P- 48	27	4	51.028
	P- 34	28	4	58.816
	P- 89	29	5	64.804
	P- 33	30	6	69.112
	P- 49	31	5	70.659
	P- 50	32	9	132.013
GROUP D	P-117	19	1	21.589
	P- 98	20	2	39.689
	P- 90	21	1	40.568
	P- 80	22	3	51.209
	P- 94	23	2	55.010
	P- 42	24	2	65.187
	P- 24	25	3	68.905
	P- 99	26	2	70.849
	P- 8	27	2	71.225
	P- 53	28	2	79.561
	P-106	29	4	79.987
Division II	R-21	13	1	6.406
	R- 5	14	2	11.111
	R- 3	15	2	12.887
	R- 6	16	4	17.404
	R-10	17	3	32.564
	*R-14	18	1	67.843

*No August Report: One-month total only.



When 34,269 technical men agree, their conclusion is worth heeding. 34,269 executives, chemists, engineers, operating men, etc., registered at the 1933 Chemical Exposition. Registrants came from 42 States of the United States and 27 foreign countries. That they invested their time and money to see what's new is the strongest of reasons for not missing this year's exposition—more vital, more valuable, more important to the paper industry in every way than ever before.

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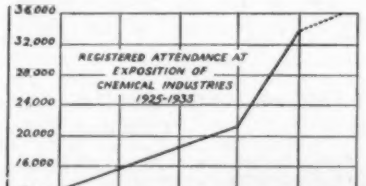

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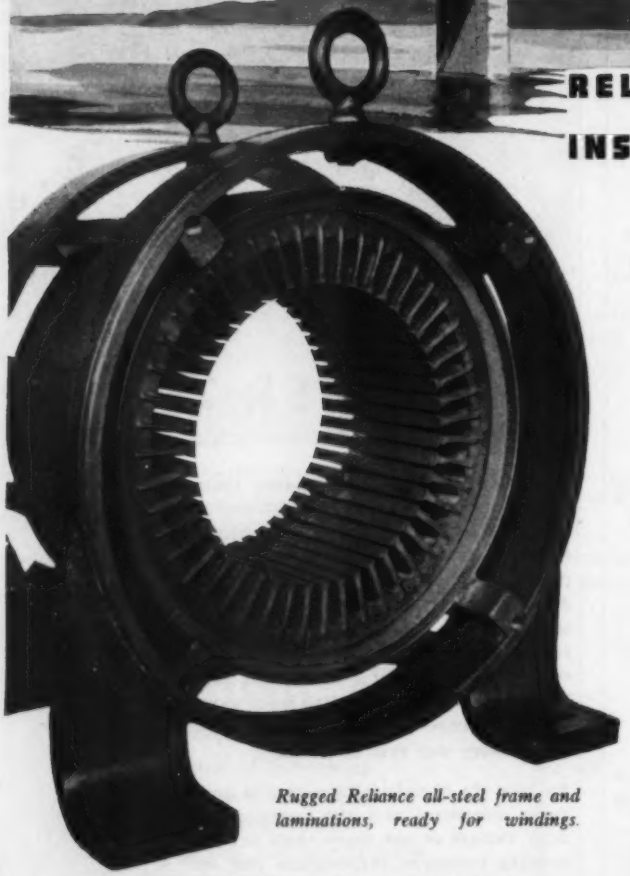

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RELIANCE A·C D·C MOTORS

POWER

GENERATION + UTILIZATION + MAINTENANCE

By W. S. JOULE

This section turns the searchlight on power and its allied problems, showing big possibilities to save. Opportunities to improve conditions, methods, apparatus will be discovered. Worth while practices suggest new ideas and wider usages of equipment.

◆ Sulphation of Storage Batteries

Sulphation is a term applied to a common and serious type of storage battery trouble which manifests itself in the formation of a white scale on the plates. This scale, known as sulphate, is almost irreducible and causes shedding of active material, buckling, loss of capacity, increase of internal resistance, and lowering of the efficiency of the cell. Since the formation of ordinary lead sulphate in a cell is a perfectly legitimate process, the formation of the white scale might, more correctly, be termed over-sulphation. Over-sulphation may be caused by excessive discharge rate, over-discharge, or too strong an electrolyte. A battery should never be permitted to stand idle uncharged after discharge, as the sulphate will form rapidly.

The best treatment for sulphated plates is a matter of opinion. Some recommend charging at very low rates for long periods of time, thus reducing the sulphate. Others believe that high charging rates give better satisfaction. Lyndon is of the opinion that the charging rate of sulphated plates should be determined by means of a thermometer, i. e., that the charging rate should be as high as possible with the temperature of the electrolyte not to exceed 105 deg. F.

◆ Electrical and Steam Engineering Meet in the Power Plant

It has not been many years since there was a fairly definite line of demarcation between the steam and electrical end of power plant work. The electrical man had his operating problems and the steam man dealt with the operation of apparatus for developing and utilizing steam.

Today, however, this distinct division of work does not exist. Electrified auxiliaries, remote control of operations by electrified means, including in many cases both heat balance and combustion, have brought the steam and electrical problems into intimate contact.

As a result power plant operators have come to look upon the problems of power production as a unit rather than as two isolated branches of engineering art. For that reason the man whose work deals primarily with the electrical side of the station must be familiar with steam problems. In the same way the steam man must have a thorough knowledge of the electrical equipment which affects operations on the steam side of the generating equipment and should also take more than a passing interest in electrical equipment beyond the generator.

There is only one road to successful station operation and that is to have a complete understanding of the station problems in their entirety.

◆ New Employees Suffer Most From Accidents

Safety Records kept by one industrial organization over a period of years shows that employees of less than 6 months' service have suffered 35 per cent of the total number of accidents, although this group made up less than 10 per cent of the payroll.

This record shows the need for the new man to study the precautions and safety measures that are employed by the older men. It serves also as a warning to foremen to use the greatest care in educating new employees, informing them of any particular hazard in their work.

◆ To Stop Static Electric Troubles

Most users of belts have had trouble with static electricity which is often a dangerous thing.

It is always caused by friction in some form or other. This may be and often is due to belt slippage. If the belt is not allowed to become too dry by keeping it treated with a good belt dressing so that it will not slip, the starting troubles can usually be eliminated.

Where this treatment fails to do the work, soft metallic brushes suspended over the belt in such a way that actual light contact is made without wearing or interfering in any way with the operation of the belt will take care of the difficulty if the brush is grounded. The remedy is frequently used and solves the problem effectively.

◆ Much May be Learned From Large Plant

It is frequently stated that the design of a large power plant is so radically different from the problems involved in layout of a small plant that the study of the large power plant, by the average engineer, is hardly warranted, except as a matter of general educational interest. Off-hand this might seem to be true; but on closer analysis it will be found that, except for the magnitude of the project and certain added refinements which are possible, the fundamentals of design are the same whether the rating is to be 1000 kw. or 400,000 kw.

There is much to be gained by following the work of the large power plant, both from the design and the operating viewpoints. The magnitude of such projects call for the highest type of engineering ability and demand the most careful analysis of modern practice. As a result the big plant is usually the composite ideas of a large number of engineers and in the design certain trends of practice are definitely solidified.

◆ Testing Steam for Moisture

Water carried from the boiler by the steam is a source of danger as well as loss and should be avoided as far as possible. Water in the steam may vary from time to time due to the variations in load, water level carried, and quality of boiler water. It is well, therefore, to test the quality of the steam occasionally in order to determine the limitations under which the boiler must be operated. This may readily be done by means of a steam calorimeter, several types of which are available for this purpose.

◆ Baffles Become More Important

Increased ratings at which boilers are operated for peak loads are testing more and more severely the baffling of a boiler. These high ratings results in a greater total draft loss through the boiler, consequently in a greater pressure differential between the sides of the baffle. At the same time, a more intense heat is carried farther through the heating surfaces of the boiler.

In order to meet these more severe operating conditions, two advances have been made in the baffling of boilers, first the use of inclined baffles to change the differential of pressure into velocity and second the use of improved forms of construction which can be readily adapted to the inclined form of construction and which at the same time will remain tight under the high temperature conditions.

In developing baffles to meet these requirements, several types of construction have been used, such as flame plates which are usually covered with high temperature cement and interlocking tile; a combination of tile and plastic refractory, and third a monolithic type made entirely of a plastic refractory material.

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TECHNICAL DEVELOPMENTS

The following abstracts are of the latest developments found in the foreign press.

IN THE PAPER INDUSTRY

◆ Small Steam Turbines

This is a brief monograph giving in some detail the advantages, general and specific applications, design, operation and maintenance of small modern steam turbines. Only the features dealing with the paper industry have been stressed in this abstract. In driving fans, generators, line shafting, pumps, etc., three types of driving units exist:—the reciprocating engine (which has been largely abandoned), the motor, and the steam turbine. Advantages of the turbine over the motor are: (1) absence of fire hazard; (2) absence of oil in the exhaust steam (of special importance in the paper industry); (3) high superheat which prolongs the life of the blade; (4) economy in floor space and erection costs; (5) lower maintenance cost due to absence of complicated gearing. The great application of small steam turbines is when low pressure steam is indicated such as feed heating and in various industries including the paper industry. A modern turbine driven feed pump, operating under a maximum water rate of 50,000 lb. per hr., a boiler steam pressure of 300 lb. per sq. in. (saturated), an exhaust steam pressure of 5 lb. per sq. in. (saturated), and a speed of 2,300 r.p.m., is shown in Fig. 1. This turbine exhausts into a deaerator. It is an ideal arrangement, where (as in a paper mill) the plant is in continuous operation, and the boilers supply ample steam over the 24 hr. period. The author discusses turbine design characteristics in some detail. Fig. 2 gives a general diagrammatic arrangement which holds for most single impulse velocity compound turbines. Here the entire steam expansion from stop valve pressure to exhaust pressure takes place in one stage through an individual nozzle or set of nozzles. The steam then impinges on rotor blade rings and the turbine performs its work. Diagram-

matic sections of various modern impulse turbines are given but have not been reproduced in this abstract. The efficiency of a single impulse velocity compounded stage is dependent largely on the ratio of the blade speed to the velocity of the steam jet issuing from the nozzles. Typical blade efficiency diagrams are given. A difficulty in the construction of small turbines results

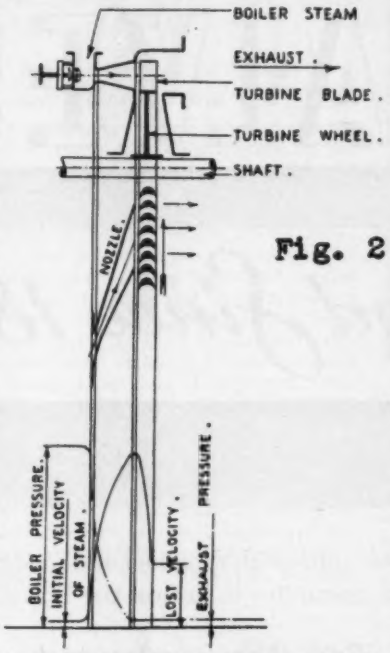

Fig. 2

from the fact that it is economical to standarize on many of its parts, hence such details as blade heights and angles, and nozzle angles must effectively cover a wide range of steam pressures and temperatures [e.g. it is possible that a steam pressure may be as low as 50 (gauge) lb. or as high as 500 (gauge) lb.] Evidently, therefore, the best theoretical design to meet a definite set of conditions cannot always be attained. When the highest grade materials and the highest type of workmanship are used, the cost of wheel, nozzle block and fixed blades of a small turbine is often 25 per cent of the total. In general, cast steel is used for live steam parts. Parts subject to exhaust steam may be of special cast iron. When, however, elevated steam pressures are used, special heat and corrosion resisting alloys must be employed. The author gives precautions required in locating high-pressure high-efficiency turbines on their bedplates; this being diagrammatically shown in Fig. 3. Small turbine bearings are usually ring-oiled. The author discusses in detail speed regulating gears that must be provided for small turbine engines: (a) horizontal shaft governor, (b) low speed governor with relay compensating-gear or (c) hydraulic pressure regulator, of which (a) is the simplest and most convenient. After discussing throttle valve design, methods of calculating throttle valve areas are given in great detail and expressed in the form of a mathematical equation. A common fault in designating throttle valves is to make the area of discharge directly proportional to the lift of the valve. This causes instability (or hunting as it is termed). To avoid this the valve should be designed so that for about the first quarter of its lift, the discharge area is relatively small, but that as the lift increases further, the discharge area also increases rapidly in proportion. The speed and direction of the flow of the steam discharged through the valve are exceedingly important factors in obtaining stability at all valve positions. Graphs are given showing the approximate relationship between throttle valve area and lift, and that between direct nozzle and throttle valve control. Claiming that text-books are often inadequate the author has dealt quite fully with throttle-valve design. In the same way he discusses at length: (a) the stability at all positions (in mathematical terms), (b) effort, and (c) spring stresses of the simple high speed governor. Fig. 4 shows a typical section of such a governor. A diagram showing the relationship between r.p.m. of the turbine and relative stability of the shaft governor is included. Somewhat less space is devoted to low speed governors and hydraulic pressure regulators. Typical performance curves for a turbine-driven

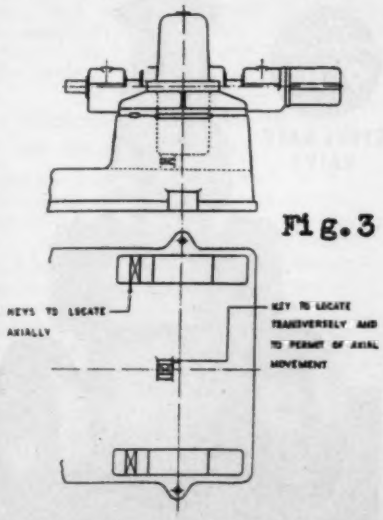

Fig. 3

boiler feed pump fitted with a hydraulic governor are included. Output curves have been plotted on the basis of: (a) dry saturated steam at the stop valve with correction curves for superheat

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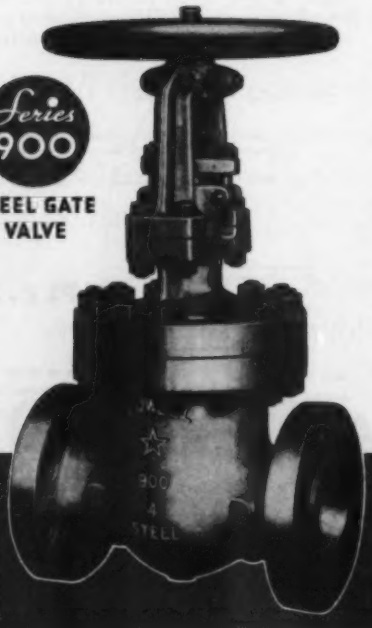

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and (b) steam at the stop valve being superheated increasingly with increase in pressure, the degree of superheat being empirically fixed from experience in modern boiler design. The author has developed a mathematical formula for the maximum power developed at the blades of any small impulse turbine, based on a constant steam speed in the inlet branch. Conditions of installation for which small steam turbines have not been designed and under which they do not operate successfully are carefully outlined. Special emphasis is placed on the consequences of exhausting the turbines directly to a condenser without first passing the steam through a back-pressure valve. Operation and maintenance of the small steam turbine is taken up only briefly. However, some sources of trouble in practice are enumerated. These include shaft vibration which causes wear of the main bearings, pitting of the throttle valve and spindles due to corrosion, distortion of the valve spindles at high temperatures, and improper governor or regulator operation. These difficulties are satisfactorily overcome by proper designing and the careful choice of special steels. In the operation of small turbines certain general important instructions in regard to lubrication, circulation of cooling water, cleaning of parts, etc., must be followed. An interesting diagram shows the disposition of electrically and steam driven boiler feed pumps arranged for automatically starting the latter. Here the failing of an electric pump will cause the falling delivery pressure to open a valve which starts the turbine. In one case it was shown that on shutting down the electric plant completely the steam pump took up the full load in 18 seconds. The original paper contains 31 illustrations. A. Flindle. The Paper Maker & British Paper Trade J. (T. S.) 89, No. 3, 38-48; No. 4, 63-4 (1935).

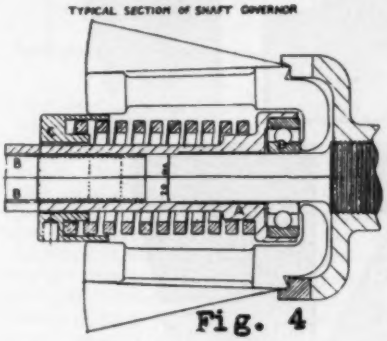

Fig. 4

◆ Acidproof Digester Cement

Experience has shown that asplit (Cf. THE PAPER INDUSTRY, June 1934, p. 199) may be used successfully in conjunction with the so-called Höchst S.W. mortar. The latter is applied directly to the digester shell, and Höchst product is also used in laying the first and second layers of brick. In the case of the inner brickwork, however, at those points where unusual strains are likely to result, the cement between the bricks is depressed to a depth of about 1.5 cm. by means of an iron tool. After setting for 4-5 days, two successive sulphite cooks are carried out in the usual manner. The digester is then carefully flushed with water and while the brickwork is still warm to the touch, a thin asplit suspension (1 part of asplit powder to 1 part of asplit solution) is applied into the grooves by means of a brush. Directly thereafter, the usual asplit cement (1 part of powder to 0.5 part of solution) is introduced. Four successive years of heavy service followed by careful inspection have proved the unusual resistance of the cement. Dietz. Papier-Fabr. 33, No. 20, 172-3 (1935).

◆ Saccharification of Wood and Ethanol Production

This address, delivered at Munich by one of the outstanding experts on the formation of fermentable sugars (glucose and mannose) from wood deserves a short abstract. The author, after taking up the history of the hydrolysis of cellulose, including the method for saccharification of wood waste, as carried out in an experimental plant in Geneva and at Mannheim with concentrated HCl, reviews the more recent hydrolytic methods used in Germany and America in which dilute acid is employed. The author's own experiences (since 1923 when he studied the kinetics of the cellulose hydrolysis under the direction of Prof. Luess) are reviewed. Cellulose, when acted upon by dilute acid at 170 deg. C. may be quantitatively converted to glucose, but at this temperature the latter suffers further degradation, in a secondary reaction. However, Scholler devised a pressure perculator (operating at 180 deg. C. and in which the acid is forced through the wood at 10 atmospheres pressure) which permits the glucose to be removed before the latter can be decomposed. The principle of the perculating pressure hydrolysis is clearly shown in the laboratory equipment illustrated by Fig. 1. Here (S) is the acid chamber, (A) is an autoclave, (U) a valve for siphoning the acid, (P) a perculator filled with sawdust and surrounded by a heating jacket, (K) a condenser and (D) is a throttle valve. In a large industrial scale, the latest development, shown in Fig. 2, is a specially devised pressure perculator with an actual capacity of 50,000 liters in which 25,000 kilograms of dry wood may be saccharified every 24 hours. The wood is compressed into the cylindrical perculator by steam blast, and acid pressure perculation is applied intermittently. The details of this operation are given and illustrated systematically. The annual production of ethyl alcohol has been approximately 1 million liters (the fermentable sugars obtained being 40 per cent of the dry weight of wood).

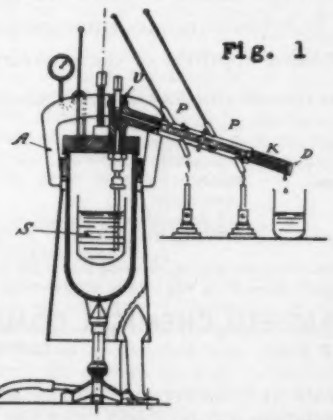

Fig. 1

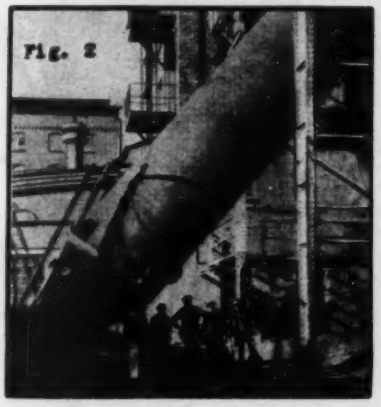
Fig. 2

This means that from 100 kilos of wood (usually pine which is far more suitable than are hardwoods) 24 liters of (100 per cent) alcohol were obtained. Hardwoods give lower yields due to their high pentosan content. The lignin residues comprise about 30 per cent of the weight of the wood. The method of separating this lignin without the formation of lignin-steam fogs is discussed. Tannins may also be recovered with the sugars in the perculation process provided hardwoods are used. The recovery of other products and the significance of sugar formation from wood in its relationship to the economic life of Germany with specific reference to fuels and foodstuffs are discussed. Heinrich. Scholler. Die Zellstoff-faser 32, No. 5, 65-74 (1935).

◆ Electrical Purification in the Sulphite Industry

Figure 1 shows schematically a layout representing a sulphur or pyrites burner from which the gases are led successively through a hot electrofilter, a cooler, a wet electrofilter, and thence into the tower. Details of the electroseparator through which gases pass (at 400-500 deg. C.) are shown in Figure 2. In this chamber, precipitation plates are hung parallel to each other, and between them (insulated against high tension) are the wire electrodes. The voltage is stepped down by means of a high tension transformer to about 60,000 volts and is then converted into a high-tension pulsating direct current in a mechanical rectifier. Details of the procedure used and halftone illustrations of the rectifiers, etc., are given in the original. It is known that the hot gases from the sulphur (or pyrites) burner carry dust and that this catalyzes the

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further oxidation of sulphur dioxide to sulphur trioxide. Since the hot electrofilter serves to separate these dust particles, it is valuable in cutting down the SO_3 content of the gas, especially when granulated, flotation pyrites has been roasted. The electrical separator is valuable also in preventing the carrying

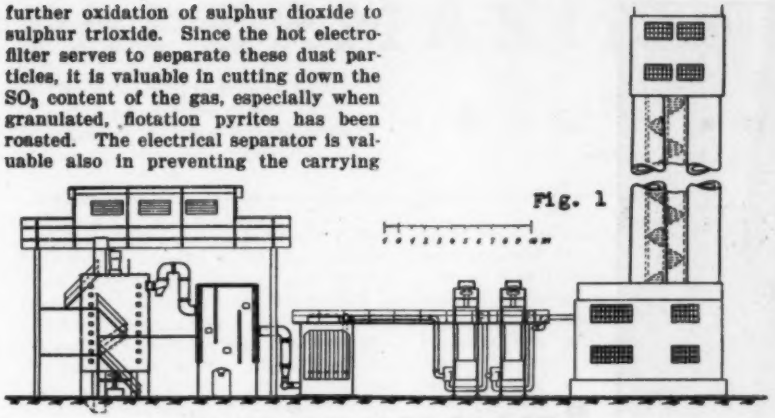

Fig. 1

over of iron compounds which would otherwise impart a red coloration to the $CaCO_3$ in the towers and to the acid liquor. These iron compounds would also calatyze SO_3 formation. Due to increased cleanliness in such a system, the final pulp is freer from specks. In conjunction with the electrical separator for hot gases, an electrical wet purifier is highly advantageous. If the hot electrofilter alone is employed the SO_3 already present in the SO_2 remains unaffected. In other words only further

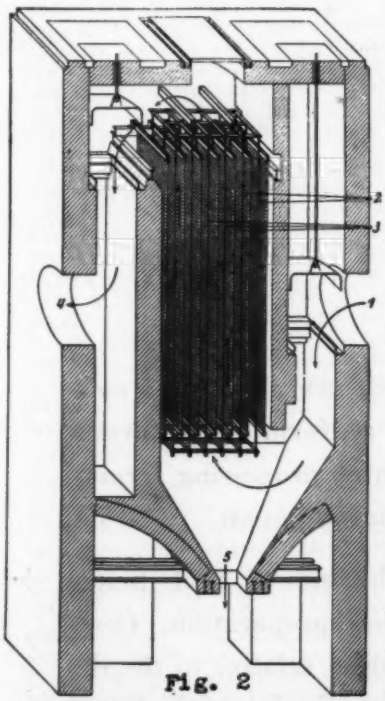

Fig. 2

oxidation is inhibited. Unless further electrofilters are employed (i.e., the wet electrofilters), the gas cooling system serves to convert this SO_3 into a sulphuric acid fog, which, when carried with the SO_2 to the limestone towers, causes a loss of lime due to the coating of $CaCO_3$ with $CaSO_4$. This is especially true in summer when the temperatures of the cooling water are relatively high. Furthermore, the presence of selenium and arsenic often enter the cooking liquors and give rise to black cooks. These disadvantages are overcome when the wet purification system follows the coolers, and the gases may be cooled to only 40-50 deg. C. instead of to 30 degrees, as in the older installations. The sulphuric acid fog is completely broken up, and the SO_2 gas enters the tower entirely free from SO_3. It is true that the final acid liquor still contains sulphates (in a few instances as little as 0.01 gram SO_3 per 100 cc. although more frequently 0.03-0.06 grams per 100), but this is due to interactions taking place in the acid tower itself. (Unfortunately, the wet electrofilter is not described by the author.) Data drawn from actual mill runs, using both the hot and wet electrofilters show strikingly the clean-cut separation of sulphuric acid in terms of kilos per 24 hours. Other advantages claimed are independence in the manufacturers' choice of sulphur-containing raw materials, the saving of lime and sulphur, and tower losses, lessened depreciation of equipment, greater uniformity in the sulphite liquor, lower operating costs, shortened periods of cooking, and improved quality of pulp. Wilhelm Hoss. Papier-fabr. 33, No. 29 T. S., 241-5 (1935).

◆ Methods of Expressing Water Analyses

The amount of any inorganic substance or ion that is equivalent to 10 mg. per liter of CaO (a weight which is taken as a standard and which is termed D° or one German degree of hardness) may be computed by dividing the molecular weight of the substance by (f) times 2.8, where (f) is a factor insuring a hydrogen equivalence in each case. For example, the hardness equivalent (Hä) for Ca_3PO_4 where (f) equals 6, is 310 divided by [6 times 2.8], or 18.4. Potassium permanganate, the molecular weight of which is 158, and where (f) equals 10, has a Hä of 5.66, etc. Thus the author lists the Hä of about 35 common compounds or ions quite irrespective of whether they are scale formers or not. In fact, some of them actually prevent scale formation. One German degree of hardness equals 1.79 French and 1.25 British degrees of hardness. These differences lie in the fact that while the Germans use 10 mg/liter of CaO or 7.19 mg/liter of MgO, the French use 10 mg/liter of $CaCO_3$ or 8.42 mg/liter of $MgCO_3$ as standard. The British use the standard of 10 mg of $CaCO_3$ in 700 cc. of water (instead of 1 liter). Simple formulas are given for converting D° into the so-called millevals (the number of cc. of a normal solution of an appropriate reagent used in determining quantitatively some specific ion in a given solution; e.g. ammonium oxalate used in the determination of Ca.) L. Suran. Papier-Fabr. 33, No. 21,181-3 (1935).

◆ Microdetermination of Lignin by Hydrofluoric Acid

By using anhydrous hydrofluoric acid, the author was able to determine the amount of lignin in very small wood samples. The acid was prepared by the thermal decomposition of pure potassium acid fluoride, in an electrically heated silver retort. The HF vapor was led through a silver condenser, and the first 10-15 per cent of the condensate which contained volatile impurities was discharged, by the use of a three-way stop-cock inserted between the spiral condenser and the silver receiver. The latter is cooled in ice water. The action of the acid permits removal of the cellulose and the pentosans, while retaining the structure of the original wood to a marked degree. Since such minute amounts of wood sample may be employed, the procedure provides a means of determining lignin in individual annual rings of the wood, and furnishes an insight into the variations in lignin content at different points of a cross section of the sample. W. Klatt. Z. Angew. Chem. 48, 112-4 (1935) through Papier-Fabr. 33, No. 32 (Abstracts) 129 (1935).

◆ Cellulose Bleaching Under Irradiation

Using Uviol or mercury vapor lamps, irradiation experiments were carried out in conjunction with the usual bleaching process. In general it was shown that this technique caused a saving in steam and bleaching liquor which might compensate for the cost of the irradiation. The final bleaching operation could be carried out with high stock density, and low concentration of the bleaching liquor, since the speed of bleaching is independent of the concentration of the bleach. In regenerating the bleach liquor, large amounts of chlorine-consuming substances were removed, thus entailing a saving in bleaching powder. The rapidity of the bleaching permits a continuous process. On the other hand since the influence of irradiation is no longer perceptible past a certain depth, major difficulties were encountered when irradiation was attempted in practical large scale bleaching operations. H. E. Wahlberg. Svensk Pappers-Tidn., 481-488 (1934) through Zellstoff-Faser 32, No. 4, 63 (1935).

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PAPERMAKING PATENTS

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Compiled by James Atkins, Registered Patent Attorney

19,686—Plant and Apparatus for Making Paper. James K. Darby, Dayton, Ohio, assignor to Beloit Iron Works, Beloit, Wisconsin, a corporation of Wisconsin. Original No. 1,939,337, dated December 12, 1933. Serial No. 307,966, September 24, 1928. Application for reissue February 23, 1935. Serial No. 7,931. 92 Claims. (Cl. 92—44). The combination with a Fourdrinier paper making machine including a Fourdrinier table provided in operation with a forming wire, a press structure and a dryer structure and having a relatively narrow aisle extending along the side of the press and dryer structures and of a width materially less than the width of said Fourdrinier table and of insufficient width to permit disposition of the width of the wire laterally of the width of the machine of a laterally extending alcove extending along the Fourdrinier table and providing lateral clearance along the table substantially equal in width to the width of said table to permit disposition of the width of the table and the paper forming wire laterally of each other and also permitting relative movement between the table and the paper forming wire for placing the wire upon said table.

2,011,609—Paper and Process Therefor. George L. Bidwell, Riegelsville, Pa., assignor to Riegel Paper Corporation, Riegelsville, N. J., a corporation of New Jersey. Application February 21, 1933. Serial No. 657,846. 8 Claims. (Cl. 92—40). Paper of the type described treated when partially dried but retaining some 70 to 75 per cent of moisture with hot wax and when further dried but retaining some 60 to 68 per cent of moisture with a plasticizer, said paper being characterized by a surface slipping readily on another similar surface.

2,012,115—Method of and Apparatus for Drying a Continuous Web. Morgan L. Woodruff, Rumford, Main, assignor to Oxford Paper Company, New York, N. Y., a corporation of Maine. Application February 17, 1932. Serial No. 593,440. 12 Claims. (Cl. 34—48). The method of supporting a web in a duct which comprises forcing a blast of gas longitudinally through the duct, removing portions of the gas from the duct proper at at least one position along the duct, and returning the removed portions to the duct proper and impinging them against the web.

The method of drying a web of paper having on its surface a wet coating containing organic material which comprises heating a fluid drying medium to a temperature in excess of 200 degrees Fahrenheit and under 501 degrees Fahrenheit, moving a stream of the medium at such temperature in contact with the web at a speed relative to the web of over 1800 feet per minute and under 5001 feet per minute, and removing the paper from the influence of the heated drying medium as soon as the desired dryness of the paper has been attained.

2,013,086—Apparatus for and Method of Making Multiwall Bags. Webster Noyes Baker, Baldwin, N. Y., assignor to Bagpak, Inc., New York, N. Y., a corporation of Delaware. Application February 27, 1832. Serial No. 595,477. 25 Claims. (Cl. 93—14). Method of making multi-wall paper bags which comprises feeding a plurality of webs of paper in juxtaposed relation, individually perforating the webs at bag length intervals, individually applying adhesive to the webs at spaced points adjacent the lines of perforations, and subsequently separating bag lengths from the webs at the perforations.

2,013,115—Process and Apparatus for the Refining of Pulp. Carl Busch Thorne, Hawkesbury, Ontario, Canada. Application September 21, 1931. Serial No. 564,199. 4 Claims. (Cl. 8—2). A pulp refining apparatus comprising in combination with a closed reaction chamber, a chamber providing a confined gas and pulp mixing zone, said second mentioned chamber having a pulp inlet and a gas-pulp mixture outlet, a screw conveyor adjacent said inlet to prevent the escape of gas therethrough and to feed pulp to said zone, means adjacent said outlet to prevent the escape of free gas therethrough, and means in said confined zone for injecting streams of gas into pulp delivered by said screw conveyor.

2,013,942—Paper Making Machine. Jacob F. Albright, Bastrop, La. Application July 30, 1934. Serial No. 737,671. 16 Claims. (Cl. 92—49). In combination with a press roll of a paper making machine, of means for stripping the paper web from said roll comprising a rotatable stripping device, driving means in frictional engagement with said press roll for rotating said device at a higher speed than the surface speed of the press roll whereby the surface of said stripping device moves in a direction opposite to and at a greater speed than the adjacent moving surface of the press roll.

2,014,142—Pressure Control System for Wood Grinders. Everett A. Mahannah, New York, N. Y., assignor to International Paper Co., a corporation of New York. Application February 8, 1928. Serial No. 252,692. 16 Claims. (Cl. 83—75). In a wood grinder, the combination of a grindstone mounted for limited radial movement, means for feeding wood against the stone to exert pressure thereon, which pressure is subject to variations, a motor for driving the feeding means, a generator for supplying current to said motor, means for driving the generator, a power line connected in series with the field and the field rehostat of the generator, a circuit connected around said field rheostat and adapted when closed to shunt the same, and means operated by the said radial movement of said grindstone for controlling said shunt circuit.

In a wood grinder, the combination of a grindstone, its carrying shaft and bearings therefor in which the shaft is movable radially, means for feeding the wood against the stone, operating means for said feeding means whereby the stone and its carrying shaft will be subjected to pressure acting to move them radially varying degrees according to the variations of pressure of the wood against the stone, a device associated with said shaft and operated by said radial movements thereof and coacting with said operating means to reverse the direction of action of the feeding means upon an undue decrease of pressure, and means controlled by said device and associated with said operating means to cause said feeding means to resume its feeding action after a predetermined period.

2,014,460—Composite Sheet Material. Alexander V. Alm, Marblehead, Mass., assignor to Dennison Manufacturing Company, Framingham, Mass., a corporation of Massachusetts. Applicatfon February 14, 1930. Serial No. 428,338. Renewed February 5, 1935. 9 Claims. (Cl. 154—46). Composite sheet material characterized by having a sheet of crepe paper and a backing, joined together by an intermediate layer of adhesive elastic rubber.

2,014,937—Method and Apparatus for Making Transparent Sheet Material. Edouard M. Kratz and Hermann Heckel, Gary, Ind., assignors, by mesne assignments, to Marbo Products Corporation, Chicago, Ill., a corporation of Delaware. Application August 25, 1932. Serial No. 630,406. 16 Claims. (Cl. 18—15). In an apparatus for producing sheet material, means for mixing constituent ingredients to be formed into sheet material in predetermined proportions, a feed roller, means for distributing the mixed ingredients uniformly the length of said roller to form a coating thereon, scraping means fer regulating the thickness of said coating and means for maintaining said scraping means at a constant temperature.

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The COMMERCIAL OUTLOOK

New York, October, 1, 1935.

IN just about every direction, indications—definite, concrete, unmistakable indications—are accumulating that business is forging ahead to better things, to broader and healthier activity based on increasing consumptive demands, to more favorable price levels, and to much more encouraging prospects. Basic statistics, indices, surveys and individual expressions of opinion in various lines of trade and covering many avenues of industry all go to show that the general condition is improving, and substantially. Moreover, the improvement is not only fully sustained but is being added to, and this is significant on the score that during the last couple of years or since the country has been striving strenuously to pull out of the depression there have been several occasions when the general situation has registered gains only to fall backward again soon thereafter. The answer would seem to be that business is at last surely on the road to actual, and, at least for a time, permanent improvement.

Commodities are rising in price as a result of stronger technical or statistical situations and larger demand; markets, wholesale and retail, are widening and consistently gaining in activity; buyers the country over are regaining confidence and are operating with a bit of the old and much desired flare; in frequent instances looking ahead and covering their needs for some time forward; carloadings are registering a steady upswing; security markets are brightening, and increasing in turnover while showing price advances; imports and exports are mounting; in fact, it can be said practically all the basic indicators point to definite improvement in the business situation.

Reports from the paper trade are in line with those regarding the general industrial condition. Paper mills are fairly busy. Certainly, most of them are enjoying the best market experienced in a long while, and are finding it necessary to gradually increase their operations to keep pace with the expanding demand for their product. Demand for paper is general; that is, the improvement which has been scored has affected nearly all classes of paper and board, and the pick up in market activity has been of such broad dimensions in several instances that manufacturers are now producing on a larger scale than in a lengthy time. Board mills, for example, are producing at 72 per cent of their capacity, on an "inch-hour" basis, according to their last report, and roofing felt mills in some cases are reported running six full days a week, and even more. Fine paper manufacturers are receiving some increase in orders, wrapping and book mills are busier, and newsprint mills are producing at a rate well above a year ago. Moreover, there seems every reason to believe that as the fall wears on and the winter approaches, demand for the various kinds of paper and board will show further expansion.

The index number of paper and board prices, at wholesale, for June was 79.7 per cent of 1926 as 100, according to the Bureau of Labor Statistics of the U. S. Department of Labor, compared with 80.0 a month before and 83.5 in June, 1934. The book paper index number was 84.8 for June, against the same figure a year ago; for newsprint, 55.7, against the same number a year before; for tissue paper, 104.7, against the same figure a year before; for chip board, 80.2, against 103.1, and for wrapping paper, 82.7, compared with the same number in June, 1934.

Newspaper circulation figures have shown a decided upturn and many publications have reached their 1929 peaks, George Moffett, of Milwaukee, president of the Central States Circulation Managers Association, told that body at a meeting in Chicago. He said the improved circulation figures reflected a general improvement in business conditions.

Advertising linage in August stood 1.8 per cent above a year previously, according to Advertising Age. Total volume carried in newspapers in 84 cities was 131,124,895 lines, contrasted with 128,781,007 in August, 1934. Retail, general and financial advertising linage showed gains over the corresponding month last year.

With Canadian output still running well ahead of last year, production of newsprint in United States mills continued to lag and the gain in total output for both countries during August over a year ago was 4.6 per cent, according to the News Print Service Bureau. Canadian mills produced 235,573 tons of newsprint in August, compared with 216,164 tons in the same month of 1934, an increase of 19,409 tons or 8.9 per cent. The United States output amounted to 75,187 tons, against 80,903 tons in August last year, a decrease of 5,716 tons or 5 per cent. Production for both countries aggregated 310,760 tons, compared with 297,067 tons in August, 1934, a gain of 13,693 tons or 4.6 per cent.

The continued increase in output of Canadian mills put the eight months' total of newsprint produced in that country this year almost on a level with the highest ever recorded for that period. Canadian mills manufactured 1,754,742 tons in the eight months, which compares with the record output of 1,766,216 tons in 1929. In 1930 the first eight months of the year showed output of 1,706,562 tons, which, with this year's total, are the only years the Canadian industry has produced over 1,700,000 tons of newsprint in eight months.

The picture for United States mills is the reverse, however. During the first eight months of the current year production in this country amounted to 609,847 tons, against 645,558 tons in the same time of last year. As recently as 1927, U. S. mills turned out 1,021,037 tons in the first eight months, the last time that more than a million tons were produced in eight months. Since then declines have been steady. Eight months' production for both countries this year totaled 2,364,589 tons, compared with 2,331,593 tons a year ago, a gain of 32,996 tons.

Production of paperboard in the United States in July reached 260,207 tons, according to the monthly summary of the Bureau of the Census, compared with 256,665 tons in the preceding month, and 201,924 tons in July, 1934. The July output brought the total for the first seven months of this year up to 1,829,852 tons, against 1,602,446 tons in the corresponding period of 1934. Board mills produced at 61.4 per cent of their rated capacity in July last, contrasted with 66.5 per cent in June this year and 52.6 per cent in July a year ago. New orders received by mills during July called for a total of 259,486 tons of board, against 248,656 tons in the preceding month, and unfilled orders held by manufacturers at the end of July were for 78,241 tons of board, compared with 78,020 tons a month before.

◆ ◆

◆ American Optical Acquires Interest in Spencer Lens

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"The present products of the Spencer Lens Company comprise microscopes, microtomes, projection and other apparatus, having a wide recognition and acceptance in the scientific world.

"The business of the Spencer Lens Company will continue to be operated under the same name, policies and personnel, with executive offices and manufacturing plant at Buffalo, N. Y., as at present."

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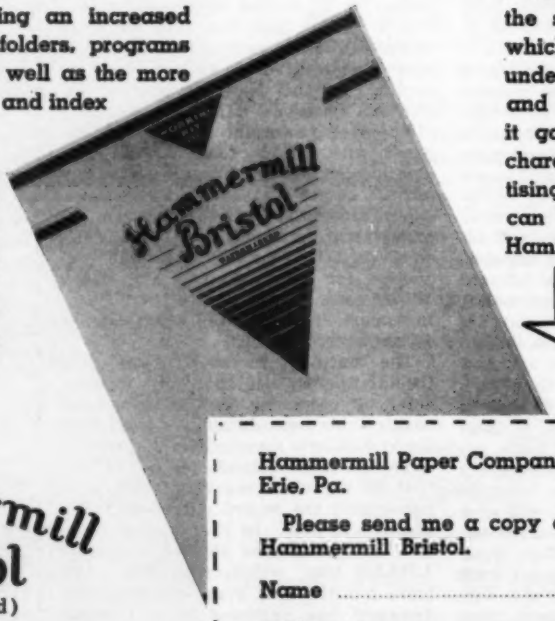

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Domestic RAW MATERIALS

◆ Papermaking Rags

Not in a long while has any class of raw material for papermaking shown so consistent and broad a price rise as have roofing rags in recent months. Sales of domestic No. 1 roofing stock have been recorded in the East at 1.80 cents a pound f. o. b. dealers' shipping points, and of No. 2 domestic at 1.45 to 1.50 cents. Probably these prices have been exceeded in some cases. In the Middle West, roofing felt mills have paid 1.70 cents freely for No. 1 domestic roofing, 1.60 cents for No. 2, and 1.50 cents for No. 3 on a f. o. b. shipping point basis. In certain instances, western mills have granted well above these figures. Foreign roofing rags have sold to mills at 2 cents a pound for linsey garments, 1.60 cents for dark cottons from mid-European sources, and 1.35 and 1.40 cents for Spanish dark cottons, ex dock New York or other U. S. Atlantic ports.

These prices, going back a few months for comparisons, represent advances in some cases of very nearly a hundred per cent within a fairly short time. The rise of the market has been healthy, based on a much broader demand from consumers and difficulties encountered by sellers in geting all the rags required to fill mills' wants. There has been a wide expansion in the building movement in various sections of the country, more especially in residential construction, which has led to a large increase in the consumption of and demand for roofing felt. Repair work on old buildings also has added to the felt demand.

The market at present has quieted to some extent but remains distinctly firm, with consuming mills taking about all the supply offered although not exhibiting quite so much eagerness to buy as a month ago. A factor in this connection is that a sudden spurt in arrivals of roofing rags from abroad added to mills' supplies and enabled them to let down in purchases of foreign stock. Nevertheless, the situation from a price standpoint continues very steady, and while the rise appears to have been at least temporarily checked, felt manufacturers are paying firm prices.

Other grades of papermaking rags, seemingly taking their cue from roofing and supported by better demand and a fairly bullish supply situation, also display an advancing trend. New cotton cuttings are moving upward in price under an improved call for supplies from fine paper mills, with the white or easily bleachable descriptions showing particular price strength. Dealers are asking at least 6.25 cents a pound f. o. b. shipping points for No. 1 new white shirt cuttings, 2.50 cents for fancy shirt cuttings, 2.25 cents for washables, 7 cents for unbleached muslins, 5 cents for blue overall cuttings, 4.75 cents for light silesias, and 6 cents for bleached canton flannels cuttings. Sales have been effected in some cases above these prices, and a feature in cuttings is that dealers are not pressing to sell while contending available supplies are none too plentiful with more lots coming in from cutting-up sources slowly and in small volume.

◆ Old Paper

After exhibiting firmness for a time, and a moderate price rise, the low grades of old paper are showing an easing tendency, at any rate in the East where supplies apparently are increasing and mill demand has let down. The established level of prices in the East is 35 cents per hundred pounds for folded newspapers and 30 cents for No. 1 mixed paper f. o. b. New York, but late reports have told of some sales at a little under these bases. On the other hand, most other waste paper grades are steady quotably or have registered slight price increases. Book stock has strengthened perceptibly. In the East No. 1 heavy books and magazines are bringing 55 cents per hundred pounds f. o. b. shipping points, while the western market is up around 70 cents at dealers' points. White shavings are selling comparatively well at prices of 2.10 cents a pound upwards, depending on quality of packing, f. o. b. shipping points for No. 1 hard white, 1.70 cents for No. 1 soft white, 2 cents for one-cut soft white shavings, and 2.30 cents for No. 1 hard white envelope cuttings. Old kraft paper is steady at 90 cents to $1 per hundred pounds f. o. b. eastern shipping centers, and ledger stock is moving freely at around 1.10 cents a pound for all-white and 80 cents a hundred for mixed colored. A grade in good call and exceptionally firm in value is new kraft envelope cuttings, for which mills are paying 1.70 cents and perhaps higher per pound at dealers' points.

◆ Rope and Bagging

Almost any and every grade of old bagging is in excellent demand and strong in price. Some large consuming interests have been actively in the market and have placed orders for sizable tonnages, with the result dealers and importers are well sold up and are exercising care in entering additional sales commitments. No. 1 scrap bagging has brought 2 cents a pound delivered at consuming centers, and No. 1 old gunny bagging has sold at this same level or higher. Foreign bagging is generally quoted above this basis, with importers stressing the difficulty they are having getting supplies abroad. Roofing bagging is firm at about 1.25 cents a pound, or probably a shade more, at shipping points for domestic, and 1.35 cents for foreign ex dock New York.

Old rope is still mainly under neglect of paper mills, with only occasional sales of importance reported. Prices are maintained nominally at 2 cents f. o. b. dealers' points for No. 1 domestic old manila rope, and 1.85 or 1.90 cents ex dock New York for foreign, but the probabilities are some sellers are shading prices.

◆ Pulpwood

There is little or no change reported in pulpwood, and the market is showing limited activity other than of routine or seasonal character, and mostly of contract order.

◆ Mechanical Pulp

Most consuming buyers seem little desirous of groundwood supplies. The report is that consumers who have their own pulp grinding facilities have been favored with ample water in mill streams for some while recently, and therefore have been enabled to produce all the wood needed, consequently keeping out of the market as purchasers. It is said, in fact, that open market activity in domestic, and also Canadian, groundwood is next to nil. Prices are on the easy side and very low comparatively, ruling almost entirely in favor of buyers. Canadian groundwood is offered at $21 per ton ex dock at New York or other U. S. Atlantic ports for pulp brought down from the Dominion by vessels, while such lots of domestic groundwood as are selling in the open trade are reported fetching only in the vicinity of $20 to $22 f. o. b. grinding plants. Quite a few producing mills in Canada are said to have shut down owing to the lack of demand and their inability to make and sell groundwood profitably.

◆ Chemical Pulp

The market for chemical pulp is looking up; there is a better buying interest, the outlook is favorable, prices are firm and in some instances a decided upward tendency is observable in quoted rates. Bleached sulphite mills are reported busy, and shipping out their product in good tonnage about as rapidly as it becomes available. Prime domestic bleached sulphite is 2.50 cents upwards per pound, ex dock Atlantic seaboard basis. Unbleached sulphite is not as firm as bleached but holds to price levels of 1.85 to 2.05 cents a pound ex dock Atlantic seaboard, according to quality. Kraft is steady to firm, and domestic bleached soda pulp is quotably maintained under a steady demand at 2.50 cents delivered book paper mills.

◆ Chemicals

A broadening of demand is noted for some papermaking chemicals. Bleaching powder is more active, and quotations firm at 1.90 to 2.10 cents per pound, in drums, at works. Casein is steady to a little firmer quotably at 11 to 11.50 cents a pound for domestic, and 12 to 13 cents for imported. Soda ash and caustic soda are moving well at fully maintained prices.

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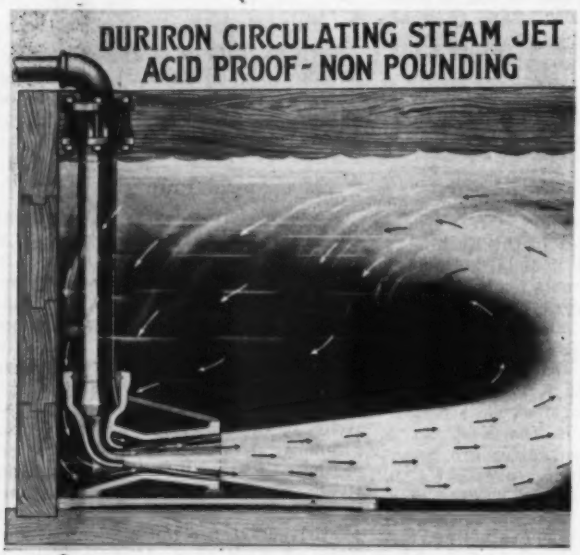

The above "cut away" view of a make-up tank shows graphically the efficiency of the Duriron method of mixing the alum solution. Perfect mix . . . perfect control.

YOU'LL LIKE this POSITIVE ALUM CONTROL SYSTEM because it Produces Better Paper at Lower Cost . . . .

Duriron Dissolved Alum Systems, including dissolving jets, pumps, valves, pipe and fittings, are meeting the demand for better paper at competitive prices.

The reason is simple to understand: *The system gives positive control over the amount and strength of the alum solution.* Consequently less alum is used and just the proper amount of the solution is put in each beater to avoid brittleness, corrosion of wires and deterioration of felts.

Better paper results, with fewer specks and seconds, and no pick-up or iron rust, as Duriron is highly corrosion-resistant.

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WORDS OF APPRECIATION

IN THE SHORT TIME since the 1935 edition of the PAPER and PULP MILL CATALOGUE has been distributed we have received numerous letters from those to whom they were sent expressing words of appreciation, and mentioning the value of the book to them. Each of their comments is appreciated because together they serve as the foundation for the building of future issues.

¶ If you have received a copy of the catalogue, use it freely. The more that you use it the more helpful it will be to you. At the same time, loan your copy of the catalogue to those about you so that they too may benefit from its contents.

» » » Address all communications to the « « «

PAPER AND PULP MILL CATALOGUE
333 N. Michigan Avenue, Chicago, Illinois

Import and Export MARKETS

IMPORTS

◆ Wood Pulp

The market for imported wood pulp is developing broader activity and showing increasing firmness. Buying by paper and board manufacturers has expanded considerably, and not only are they purchasing to cover more or less direct needs but also are looking a good ways ahead in acquiring supplies, in frequent cases placing contracts for sizable amounts of pulp against 1936 requirements. It would seem that consumers have regained confidence in the pulp market outlook, and, evidently having come to the conclusion that prices are destined to remain firm or else move to higher levels, are not hesitating in numerous instances to buy freely and well into the future.

Within the last several weeks, the pulp market has witnessed something which it has not seen in a lengthy spell; namely, an actual price advance in a class of chemical pulp. The market level for kraft pulp has risen some $2 to $3 a ton, and it can be said the advance is based on absolutely healthy factors—a steady and fairly voluminous demand from consuming quarters, a well sold up position of producing mills, comparatively limited offerings, and readiness on the part of buyers to pay slightly higher prices for desired supplies. While the price basis on prime imported kraft pulp was for a long time 1.70 cents per pound ex dock American Atlantic seaboard, it is stated purchases of strictly prime kraft are no longer feasible at this figure, most sellers asking 1.80 or 1.85 cents, and 1.80 cents regarded in numerous corners of the trade as the bottom level at which tonnage purchases abroad can be effected.

Bleached sulphite also displays price firmness, and there are predictions in the trade an advance in this class of pulp will be registered shortly. Mills are reported well sold up for a time, and exercising a certain degree of caution in entering additional sales commitments at prevailing prices. Prime bleached sulphite of foreign origin is quoted from 2.50 cents upwards a pound ex dock American Atlantic seaboard, with some grades held at 2.65 and 2.75 cents, and higher.

On the other hand, unbleached sulphite is relatively quiet marketwise, and the price tone in this pulp is not so firm. There has been no change in quotations, and producers are not pressing too hard to sell, but it would seem the technical position of such pulp is not as favorable as is the case in kraft pulp and bleached sulphite. Reports from abroad say a surplus of unbleached sulphite has been built up, and that producing mills are considering further production restrictions. Prime strong unbleached sulphite is quoted at 1.85 to 2.05 cents a pound Atlantic seaboard, depending on grade. Quotations on all imported pulps for Lake port shipments are $2 to $3 a ton above Atlantic seaboard bases.

Importations of wood pulp into the United States during July, while slightly less in total volume than in the preceding month, compared fairly well with other previous months this year, reaching a total of 135,112 net tons of 2,000 pounds, air dry weight, of chemical pulp, valued at $5,179,470, according to U. S. Department of Commerce figures. These imports compared with 138,754 short tons of chemical pulp of a declared value of $5,218,499 imported in June this year, and 133,956 long tons of a value of $5,321,656 in July last year.

Groundwood imports in July amounted to 10,460 short tons of a value of $188,856, compared with 14,950 short tons of a value of $274,302 in the month before, and making a total for the first seven months of this year of 90,869 short tons, against 88,613 long tons in the same time a year ago.

◆ Paper Stock

Imports of papermaking rags into the United States in July last amounted to 14,168,381 pounds, valued at $186,089, according to official Department of Commerce statistics, making a total for the first seven months of this year of 93,186,528 pounds of a declared value of $1,031,308, and showing an appreciable rise over the 66,347,298 pounds of a value of $842,827 imported in the similar seven-month period last year.

◆ Paper

Newsprint imports into the United States during July dropped off somewhat compared with both the preceding month and July, 1934. That prices on the average were lower is indicated by the fact that July receipts of 190,872 tons, valued at $6,532,467, represented a decrease of 3 per cent in volume but were 5 per cent lower in value compared with the corresponding month last year. July imports were 6 per cent in volume and 7 per cent in value under June of this year.

Total imports of paper and paper products in July reached a value of $7,238,231, making a total for the first seven months of this year of $50,521,409, contrasted with imports of a declared value of $49,499,851 in the same seven-month period of 1934.

EXPORTS

Exports of paper and paper products from the United States during the month of July continued to register an upward trend, shipments of all classes of paper, board and converted products reaching a total value of $1,807,695, an increase of close to 20 per cent over June and, also, over the same month of last year. A comparison of the quantity figures for various classes likewise shows, in most instances, a rise in the July, 1935, exports. Newsprint exports, which have been running far ahead of last year, dropped off nearly 40 per cent compared with June, but were more than six times the July, 1934, shipments. Book paper exports were 15 per cent higher than in the preceding month yet slightly less than a year ago. Writing paper exports did not change much during July as compared with June but were nearly double those of the same month in 1934.

Exports of both surface-coated and tissue and crepe papers exceeded those of June, 1935, and July a year ago. In the coarse paper field, shipments of wrapping papers, as well as overissue newspapers and boxboards exceeded both June and the same month last year. The increase in boxboard shipments, however, was about offset by losses in the other classes of paperboards. Exports of building papers, on the whole, showed improvement. Shipments of wallboard declined nearly 40 per cent as compared with June and were also less than during the same month of last year. This loss was more than offset, however, by gains in exports of insulating boards and sheathing papers.

Exports of newsprint in July were valued at $43,405, against $9,556 in the same month of 1934; of wrapping paper, $172,941, against $148,039; of writing paper, $150,388, against $95,035; of uncoated book paper, $100,375, against $95,551; of surface-coated paper, $100,662, against $97,754; of tissue and crepe paper, $57,200, against $49,131; of fibre insulating board, $139,413, against $123,486; of boxboard, $110,427, against $66,111; of other paperboard, $55,427, against $91,326, and sheathing and building paper, $25,515, against $11,666.

Exports of paper base stocks in July declined compared with the same month last year. Shipments of sulphite pulp and rags, which make up the bulk of these exports, dropped off more than 50 per cent contrasted with a year ago. Shipments of sulphite were also 17 per cent under the preceding month's exports. Total exports in this group were valued at $469,944 during July, compared with $558,279 in June this year and $898,823 in July last year.

ADVERTISING PAGE REMOVED

SENSATIONAL VALUES

Ready for Immediate Shipment

TRANSFORMERS
60 Cy., 1 Phase

3—500 G.E., 23000/2300/4000.
3—300 G.E., 6600/13200/2300.
3—250 G.E., 2200/6600/230/460.
3—150 Maloney, 4000 with taps, 230/460.
3—150 G.E., 4000 with taps, 230/460.
2—125 G.E., 2200/230/460.
3—75 G.E., 11000/2300 (new).
3—25 G.E., 2300/230/460.
2—50 WEM., 4400/2200/230/460.
2—37½ WEM., 2300/230/460.
3—37½ G.E., 2200/122/244.
1—25 WEM., 440/110/220.
2—10 G.E., 2300/230/460.
2—3 WEM., 2300/115/230.
2—5 WEM., 2300/115/230.
2—15 G.E., 2200/110/220.
Above is only a partial list of units in stock.

TURBINES

1—35 K.W. G.E., 3600 R.P.M., 250 V. D.C.
1—25 K.W. G.E., 3600 R.P.M., 250 V. D.C.
Above non-condensing 125 lbs. pressure in A-1 condition.

A. C. MOTORS
440 V., 60 Cy., 3 Phase

2—250 H.P.	Cr. Wheeler	Sq. Cg.	1800 R.P.M.
1—300 H.P.	G.E.	Sq. Cg.	1800 R.P.M.
1—150 H.P.	G.E.	Sq. Cg.	1800 R.P.M.
1—200 H.P.	WEM	Sq. Cg.	1200 R.P.M.
1—200 H.P.	G.E.	Sq. Cg.	1800 R.P.M.
1—150 H.P.	WEM	Sq. Cg.	1200 R.P.M.
2—125 H.P.	ALLIS	Sq. Cg.	1200 R.P.M.
1—100 H.P.	WEM	Sq. Cg.	1800 R.P.M.
1— 75 H.P.	WEM	Sq. Cg.	1800 R.P.M.
3— 75 H.P.	G.E.	Sq. Cg.	1200 R.P.M.
2— 75 H.P.	WEM	Sq. Cg.	1200 R.P.M.
3— 50 H.P.	G.E.	Sq. Cg.	1200 R.P.M.
2— 50 H.P.	G.E.	Sq. Cg.	1800 R.P.M.
1— 50 H.P.	WEM	Sq. Cg.	1800 R.P.M.
2— 75 H.P.	ALLIS	Sq. Cg.	1800 R.P.M.
4— 50 H.P.	G.E.	Sq. Cg.	900 R.P.M.
4— 50 H.P.	WEM	Sq. Cg.	900 R.P.M.
1— 50 H.P.	WEM	Sq. Cg.	575 R.P.M.
3— 40 H.P.	G.E.	Sq. Cg.	680 R.P.M.
2— 40 H.P.	G.E.	Sq. Cg.	600 R.P.M.

Approximately 400 other smaller sizes in various speeds, makes, etc.

1—400 H.P.	G.E.	Slip ring	900 R.P.M.
1—250 H.P.	ALLIS	Slip ring	580 R.P.M.
1—200 H.P.	WEM	Slip ring	500 R.P.M.
3—100 H.P.	WEM		900 R.P.M.
2—100 H.P.	WEM		680 R.P.M.
1—100 H.P.	WEM		1200 R.P.M.
3— 75 H.P.	G.E.		900 R.P.M.
1— 75 H.P.	WEM		690 R.P.M.
1— 75 H.P.	WEM		900 R.P.M.
1— 50 H.P.	ALLIS		870 R.P.M.
1— 50 H.P.	G.E.		600 R.P.M.
1— 75 H.P.	WEM (new)		1435 R.P.M.

Approximately 100 other sizes and speeds in various makes.

ENGINE SETS

1—150 K.W. G.E., 125 v. D.C., 2 wire, direct connected to Skinner Uniflow, complete with panels. Like new.
1—150 K. W. G.E., 125 v. D.C., 2 wire, direct connected to Ridgeway 4 valve Corliss with panel.
Also a number of other sizes.
Above are extreme bargains. Can be seen on foundation and operated, if desired.

MOTOR GENERATOR SETS

4—G.E., 200 kw., 250/275 v., 60 cy., 3 ph., A.C., 1200 r.p.m., factory built synchronous motor generator sets with full automatic control for A.C. end. Sets used about one year.
1—W.E. & M., 200 kw., 2300 v. A.C., 275 v. D.C. synchronous. Complete.
1—G.E., 250 kw., 2300/4000 A.C., 250 v. D.C.—very late type, synchronous.
1—G.E., 300 kw., 440 v. A.C., 275 v. D.C. Complete with A.C. and D.C. panels. Synchronous.
1—W.E.&M., 150 kw., 275 v. D.C. Rotary converter, complete with 3 transformers, 2300/4000 and complete switchboard equipment. Almost new.
1—G.E., 500 kw. HCC, 275 v. D.C. Rotary converter, complete with 3 transformers, 2300/4000 and complete switchboard. Just rewound. Like new.

A. C. MOTORS
2200 V., 60 Cy., 3 Phase

1—200 H.P.	WEM	Sq. Cg.	1800 R.P.M.
1—200 H.P.	ALLIS	Sq. Cg.	1800 R.P.M.
2—300 H.P.	G.E.	Sq. Cg.	1200 R.P.M.
1—300 H.P.	ALLIS	Sq. Cg.	900 R.P.M.
1—400 H.P.	G.E.	Slip ring	900 R.P.M.
2— 75 H.P.	G.E.	Slip ring	600 R.P.M.
1— 75 H.P.	G.E.	Slip ring	900 R.P.M.
1— 75 H.P.	WEM	Slip ring	435 R.P.M.
3— 50 H.P.	G.E.	Slip ring	600 R.P.M.
1—150 H.P.	G.E.	Slip ring	435 R.P.M.
1—125 H.P.	ALLIS	Slip ring	435 R.P.M.
1— 50 H.P.	G.E.	Slip ring	900 R.P.M.

All above continuous rated, and control equipment can be furnished with most.

The above is only a partial list of the large stock of equipment we have in our own Warehouse. In addition, we have approximately two thousand Westinghouse 230 V. Type SK motors from 1 H.P. up to 100 H.P. in various speeds. *We believe this is the largest Dealers stock of Westinghouse SK motors available.*

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